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MALIGNANCY OF THE GALLBLADDER

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This paper is limited to the consideration of malignancy of the gallbladder itself and excludes all the ducts associated with the biliary system to and through the papilla of Vater. Furthermore, this contribution does not include the secondary or metastatic involvements of the gallbladder nor its ducts. All arguments, therefore, will revolve about primary malignancies of the gallbladder itself.

The difficulties that beset the surgeon and general practitioner in convincing the cholecystitis patient of the necessity for operation, especially if the *x*-rays show definite shadows of calculi or papillomata, may be ameliorated by using the argument so frequently used by the late John B. Deaver and others: that the presence of calculi in the gallbladder always presents a factor of irritation to the mucosa that is or may be a cause in cancer production of the gallbladder.

From personal observation in about 3,000 operations upon the gallbladder I do not care to influence my patients to be operated upon by using the cancer argument. In using such an argument one must be certain that his operative results as to mortality are less than the incidence of malignancy; otherwise one feels that the patient be allowed the chance of having a malignancy arise rather than risk the operative death incidence. Naturally I am not including other reasons for operation such as invalidism produced by the cholecystitis, perforation, gangrene, empyema, recurrent or repeated attacks of pain, loss in weight, digestive disturbances, *etc.*

From January 1, 1929, to January 1, 1934, a period of five years, my records show 525 operations, 522 of which were cholecystectomies and three cholecystostomies, with a mortality of fifteen cases, equalling 2.85 per cent. Malignancy was demonstrated in but six of the entire list of operations, five of which were carcinoma and the sixth a sarcoma. This latter type of growth is an exceptionally unusual occurrence. In conversation with members of the staff of the Pathological Laboratory at the Post-Graduate Hospital it was stated that but thirty-five or thirty-six sarcomata of the gallbladder have ever been recorded.

In this list of operations the females recorded number 336, the males 108, so that the preponderance in the female is about three to one. There were

eighty-one patients whose sex was not recorded. The oldest patient was over eighty-two, the youngest was nineteen. The average age in 400 operations was forty-four years. Cholelithiasis was recorded 263 times in 383 patients. A cholecystectomy with a transduodenal choledochostomy was done in a female eighty-two years old with a remarkable speedy recovery. Perforation of the gallbladder was found several times, one of which was in one of the cases of malignancy (Case III). During 1929 I operated upon 111 patients for cholecystitis with no malignancies found. Mortality followed in two cases, less than 1½ per cent.

If found in the abdomen the appendix is removed by me in practically every case. There were numbers of multiple operations done; acute pancreatitis associated with cholecystitis; eight patients with ovarian cysts in addition to the cholecystitis; fifteen combined hysterectomies and cholecystectomies; two cases of hepatic cysts of nonspecific organism type; two with added operations for renal calculi; sixteen with added operations for duodenal ulcer; two with associated abscess of the liver due to empyema of the gallbladder which had perforated into the liver.

Referring back to the arguments as to mortality and incidence of malignancy, the records show fifteen deaths or 2.85 per cent, with a malignancy incidence of but six patients out of 525 operated upon or a percentage of 1.14 per cent, less, as can readily be seen, than one-half of the mortality from operation.

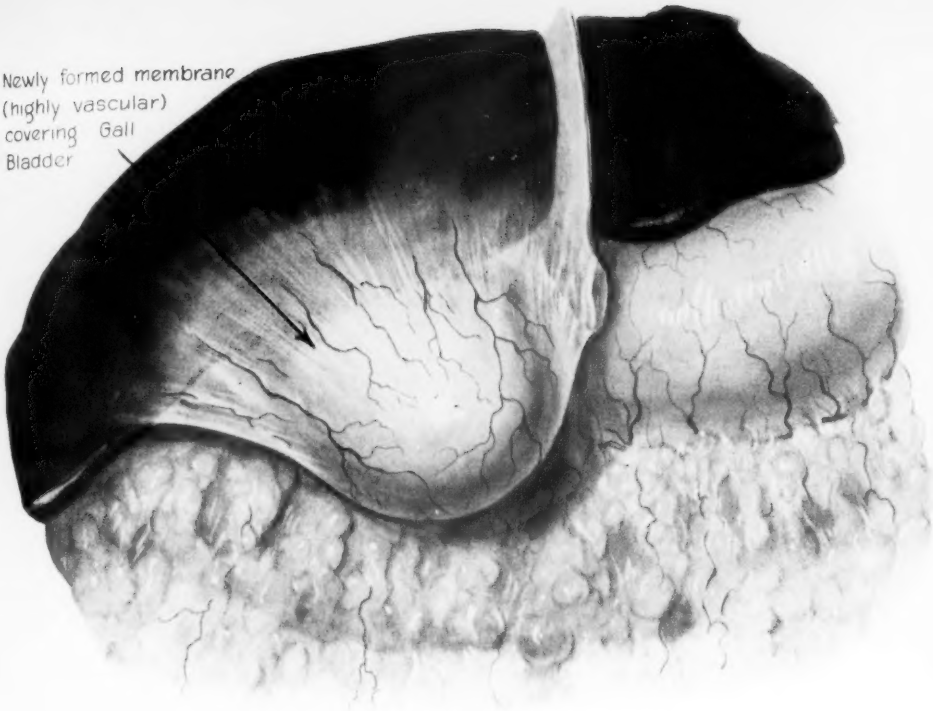
Factors other than those of irritation by stone, the presence of papillomata, the recurring attacks of infection as a source of irritation must be weighed very definitely. The deposit of lipoid material as found in the commonly called "strawberry" gallbladder may also be a factor well worth consideration.

In my argument of mortality versus cancer incidence may I say that I express very positive arguments to the patients who require operation but I do not induce them to consider the operation because of the malignancy incidence any more than I use cancer possibility to the patient with a lacerated cervix as an argument to have the cervix repaired.

In my records the average age of the cancer-bearing patients was forty-eight years. As to sex, the predominating evidences of cholecystitis were in women. Therefore, malignancy of the gallbladder is or should be more frequent in the female.

In all the patients in whom carcinoma was found upon operations for a diseased gallbladder a stone or stones or biliary sand was found.

There are no symptoms nor signs which are sufficiently important on which the diagnosis of carcinoma can be based except, of course, in those patients in whom metastases are already present. There has been no patient in whom I found malignancy of the gallbladder upon operation who has not called attention at first to the onset of pain with its distributions or radiations; then to the ordinary digestive signs and symptoms—bloating and full-feeling after meals. The loss of weight often varies in the noncancerous gallbladder from a few pounds to forty-five pounds with no blood impairment



Sarcoma of Gall Bladder

FIG. 3.—(Case IV.) Appearance of gall bladder *in situ* covered by vascular membrane.

Sarcoma of Gall Bladder

FIG. 4.—(Case IV.) Gross section of extirpated gall bladder showing greatly thickened wall, with calculi *in situ* and nodulated masses of sarcomatous growth.

Papillary Carcinoma
of Gall Bladder

FIG. 2.—(Case II.) Showing the carcinomatous excrescence springing from the junction of the upper part of the cystic duct with the gall bladder.

so that loss of weight alone cannot be considered a factor nor a sign. Jaundice does not occur except where metastases have invaded the liver or ducts. The other digestive manifestations are those of an ordinary cholecystitis.

The treatment for primary carcinoma of the gallbladder is cholecystectomy when feasible. It is interesting to note the present-day feeling of many operators as to the question of ostomy versus ectomy in operating for gallbladder diseases. For years many of us have been teaching, advocating and

FIG. 1.—(Case I.) Showing the two areas of lessened density in the *x*-ray of the gallbladder, indicative of the presence of papillomata.

demanding ectomy except in a few patients in whom the condition is so severe that it is inadvisable to add five or ten minutes for a removal. Many of the strong advocates of ostomy for years have recently come out for the radical operation. It is quite possible to overlook papillomata and malignancy when one does the usual type of ostomy but in doing an ectomy the entire carcinoma bearing area is removed if either the carcinoma is present or the potential makings of a carcinoma are there.

CASE REPORTS

CASE I.—A young man, twenty-eight years of age, came under my care in 1932 with a typical history of cholecystitis. After one visit he disappeared to return in May of

1934 with a history of repeated attacks. He finally submitted to an *x*-ray series which presented a positive picture of two papillomata, one the size of an ordinary pea, the other the size of a split pea. This patient, unless operated upon, presents the potential carcinoma possibility, as any papilloma, no matter in what structure, is liable to undergo a malignancy (Fig. 1).

CASE II.—A female, aged sixty. Examined in July, 1933. For years she had had attacks in the upper right quadrant, so severe that hypodermics of morphine were required. She had never been jaundiced. The pain radiated through to the back and right shoulder. There was a loss of thirty pounds in weight, and a considerable amount of belching and bloating. X-rays with dye were negative as to any type of shadow. Physical examination revealed a patient well padded with fat and exquisitely tender in the upper right quadrant. Operation was advised.

Operation August 7, 1933. Upon exposure of the abdominal contents the gallbladder presented a suspicious carcinoma picture with what appeared to be metastases in the pancreas. A cholecystectomy and cholecysto-docho-gastrostomy were done. The latter was done in what was considered to be an healthy cystic duct. The report of the pathologist was "adeno-carcinoma of the gallbladder imposed upon chronic productive inflammation. Cholelithiasis" (Fig. 2).

It will be observed from this illustration that the growth started at the junction of the upper part of the cystic duct with the gallbladder. A long, pine-tree-shaped mass lay free in the cavity of the bladder with its pedicle at the opening of the cystic duct. This patient died within ten months of her discharge from the hospital.

CASE III.—Male, sixty-six years of age, an insurance broker. Examined May 24, 1933 at 5.30 P. M., at which time he was suffering from a very severe generalized abdominal pain. He gave an history that at eleven o'clock that morning he felt ill but had no pain, took lunch at noon and then at three o'clock had an excruciating pain in the right side. At five o'clock the pain was so severe he sent for me. Although an intelligent and college bred man it was impossible for me to extract any history of any illness preceding the immediate onset of pain. Postoperatively an history of previous attacks of pain was obtained.

His temperature was 101.2°, pulse 130. He was extremely tender all over the abdomen. Appreciating the acute condition he was sent to the hospital. The blood count was 22,000 whites with a differential of 88 per cent polymorphonuclears.

Upon opening the abdomen, using a low gallbladder incision, I was surprised to see quantities of purulent fluid and numerous particles that resembled coagula of milk pour out. The appendix was relatively normal. I searched for an opening in the stomach and duodenum. While pushing the duodenum, which was adherent, away from the gallbladder a hole was found in the lower portion of the latter from which pure pus and small black stones were being discharged. The gallbladder was of a pronounced fibrous type, the walls being fully one-eighth to three-eighths of an inch thick. While making a very difficult removal, I was struck by the possibility of a malignancy and made a special request that the specimen be examined for cancer. The report was exceptionally gratifying: "a marked fibrous cholecystitis with total destruction of the mucosa." The patient made a very rapid recovery, being discharged in three weeks.

On January 6, 1934, he consulted me again saying that he had had some pain about a week previous. He had a mild degree of jaundice which, in the light of the pathologic report, caused me to accuse myself of having left in a stone or stones or else he was a case of common duct contraction. He was examined every three or four days until February 1, when I sent him to Dr. Harlow Brooks for review, stating that I could feel a definite enlargement and possible nodulation of the liver. I believed that my suspicion of a malignancy at the time of operating was now being verified. Within a week he was rehospitalized and I operated upon him February 7. The findings were many metastases in the liver and the entire gallbladder fissure was filled with a hard nodular

growth. Biopsy specimens were taken and reported by the same pathologist who had examined the gallbladder, as a "metastatic carcinoma." This was done without the pathologist's knowledge that the two specimens were taken from the same person. Upon my request that the gallbladder be reexamined, which fortunately was in the laboratory library, the pathologist said that after careful sectioning of the vicinity of the perforation he was astounded to find a definite carcinoma. The patient died three months later.

CASE IV.—Mrs. S., fifty-two years of age, was seen by me on August 31, 1933. She gave an history that she had had pleurisy two years previously, and now complained of "feeling bad" for the past seven days. She pointed to her right lower quadrant. There was no loss in weight, no vomiting, no bleeding, some constipation but she continually emphasized the pain in the right lower quadrant. Menopause had occurred four and one-half years before.

Physical examination revealed a tumor the size of a grapefruit involving the upper right quadrant, extending downward and inward to the umbilicus. No *x*-rays were taken as the tumor was evident, and apparently was not intestinal.

She was operated upon on September 16, 1933, at which time an enormously enlarged gallbladder was found with large areas of newly formed veil-like tissue extending from the liver to the gallbladder (Fig. 3). The gallbladder was easily removed. Section showed five stones, three of which were about one inch long and the other two about three-eights of an inch long. The wall of the gallbladder was from one-half to one and one-half inches thick with several large nodulated masses of a livid to purple hue. There was no bile present (Fig. 4). A densely organized and highly vascularized membrane extended from the gallbladder to the transverse colon which was also very easily removed. The pathologic report was "highly malignant, spindle cell sarcomata, myosarcomata, cholelithiasis."

There was a rapid growth following the operation so that by November 1, 1933, her condition was pitiable. X-ray therapy was used with unfortunately resulting nausea to such an extent that the patient refused further treatment. Death was reported as having occurred about the middle of February, 1934.

In reviewing an article by Dr. G. DeGaetani[1] of the Institute of Pathological Anatomy of the Royal University of Catania, Italy, thirty cases are cited, including one of his own, of sarcoma of the gallbladder. These are reported in the literature up to and including January, 1932. On surveying these cases I find it necessary to eliminate on account of questionable diagnosis five of the citations so that we have in his report at least twenty-seven undoubted cases of primary sarcoma of the gallbladder. Fourteen of these were operated upon. The remaining thirteen were found incidentally at autopsy. The ages ranged from twenty-nine to eighty-four.

It is interesting to note in his elaborate résumé of the literature that stone takes precedence as being the etiologic factor. Fully 95 per cent, according to Riedel are produced by calculi. Harterfeld is quoted as finding it in 73 per cent, while numerous other authors also state that calculi are factors. This article more than emphasizes the rarity of the sarcomata involving the gallbladder.

REFERENCE

[1] DeGaetani, G.: Pathologica, vol. 24, pp. 541–551, 1932.

CYSTIC DISEASE OF THE BREAST

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Since Reclus first described the pathological and clinical picture of the breast lesion which has since borne his name, this condition has intrigued the surgeon and the pathologist alike in the elucidation of the many intricate problems connected with its pathogenesis and its treatment. The voluminous literature which has grown up about this subject with the divergent views expressed therein supports one in the feeling that perhaps even another addition to it cannot bring more chaos than already exists; but, on the basis of clinical experience, may clarify the treatment of a condition which holds so much of import for the happiness and even life of a great number of women. It is natural that a common condition, whose genesis, relation to inflammation, and neoplasia, have been variously stated should have been deemed worthy of much pathological investigation. This applies all the more to a clinical study which has as its objective the establishment of a rational therapeutic plan based upon clinical experience. That there is at present little unanimity of opinion is attested by the divergent views expressed by various authors whose recommendations range from expectant observation to radical surgical procedure.

Before Astley Cooper in 1828 published his "Illustrations of the Disease of the Breast," cysts were in general believed to be malignant tumors. He was the first to regard the condition as benign although he recorded one case in which a cyst and a carcinoma coëxisted. Velpeau wrote of the bilaterality of the lesion. Sir James Brodie (1846) afforded us the first accurate study of the disease. His description in "Lectures on Pathology and Surgery" covered both the clinical and the pathological aspects of the subject. He called attention to the possibility of the recurrence of the lesion if the whole of the mammary gland was not removed. He regarded the cysts as benign but did not preclude the possibility of the development of carcinoma. Billroth (1880) described a similar cystic condition of the breast, believing them to be retention cysts. Reclus (1883) and in subsequent publications described the condition both from an anatomico-pathological and clinical viewpoint and called the lesion "Maladie Kystique des Mammelles." His publications, briefly summarized, stressed the formation of multiple cysts, the bilaterality of the lesion and its treatment. He called attention to the possibility of a serosanguineous discharge from the nipple being present. Brissaud (1884) exhaustively investigated the histological aspects of the disease and especially the accompanying epithelial proliferation. In Germany, Schimmelbusch (1890) regarded the lesion as a true tumor with cyst formation and called it

"cystadenoma mammæ." He found carcinoma in three out of forty-three cases. König (1893) thought the condition to be of an inflammatory nature and first called it an interstitial mastitis. He believed the inflammation in the connective tissue to be the primary process, the epithelial proliferation to be secondary. He afterward changed the name to chronic cystic mastitis. Holding both the views of Schimmelbusch and König to be correct, Sasse (1897) divided cyst formations into two separate groups, which he believed to be essentially different—the first manifesting itself through a cystic dilatation of the excretory ducts without proliferation of epithelium. He explained the process on the basis of an inflammatory reaction with shrinkage of the connective tissue, the cysts as the result of retention. His second group was characterized by epithelial proliferation. For this group he suggested the name "polycystoma mammæ epithiale." Bloodgood (1906) called the condition "senile parenchymatous hypertrophy." He described three forms of the process. The first of these he called the cystic in which he found in one or both breasts one or more smooth-walled cysts, and the adenocystic, in distinction to the first, in which the dilated ducts and acini were filled with proliferating epithelial cells. The latter he looked upon in his first communication as distinctly precancerous and advised either unilateral or bilateral mastectomy. He has since then in various publications altered this opinion and his later views will be referred to subsequently. Von Saar (1907) believed the cystadenoma to be a phase of a physiological involution ending in carcinoma. He directed particular attention to the "pale" epithelium lining the acini, which consisted of large cylindrical cells with a fine granular cytoplasm. Bertels (1913) believed the connective-tissue hyperplasia to be the primary process. The dilatation cysts were the result of the acini becoming separated and strangulated with their secretion continuing and dilating them. Transition to carcinoma he believed to be relatively frequent but in his experience only a small proportion of mammary carcinomata developed from "chronic cystic mastitis." Other observers, notably Dietrich and Marchand, agreed with Bertels and called the condition "fibromatosis mammæ." Krompecher (1916 and 1924) divided mammary cysts into two groups: (1) hidrocystomata; (2) retention cysts. The former contained the pale epithelium of v.Saar which he believed to be of the same character as the epithelium in sweat glands. As the mammary gland is known to be developed from a sweat gland anlage, Krompecher thought these cysts represented an anomaly of development. The second group he assigned to those cases in which the cysts were microscopic. He called them "polycystoma mammæ simplex hidrocysticum." In cases in which there existed a pronounced papillary ingrowth of epithelium into the ducts or acini, the papillary cystadenomata, he believed to be neoplastic. Pribram (1919) believed the process to be neither inflammatory nor neoplastic but degenerative. While many other contributors to this subject have been omitted, it is not difficult to understand from this brief summary of the divergent views of both clinicians and pathologists, as to the essential nature and underlying pathological process that various names have become

attached to this clinical syndrome. Among these the most commonly referred to in the literature are chronic cirrhosing mastitis (Billroth); polycystadenoma mammæ (Brissaud); maladie kystique de la mammelle or Reclus' disease; cystadenoma of the breast or Schimmelbusch's disease; chronic cystic mastitis (König); senile atypical parenchymatous hypertrophy (Bloodgood); fibromatosis cystica (Semb). In the past few years interest in this subject has again taken on new vigor by the excellent work of Cheatle and his co-worker Cutler, Semb and Askanazy. Their opinions will be referred to later. From this brief review it is evident that no wholly satisfactory name for the condition now under discussion has been found. Some are based on what the author believes to be its etiology, others upon a pathogenetic basis. I have therefore concluded to obviate the possible defects in either of these and use the all-inclusive but in many respects indefinite term of cystic disease of the breast.

Pathology.—In the foregoing paragraph the gross and microscopical nature of the lesion encountered in this disease have been alluded to and in the sense that this paper is primarily clinical only a brief résumé of its anatomical and histological nature will be discussed. A grasp of the various pathological lesions making up this symptom-complex must be had before its clinical problem can be well understood. In the main under the term cystic disease of the breast as commonly used we group two large subdivisions, the first considered by Cheatle and Cutler a physiological rather than a pathological process which they choose to call mazoplasia, in which there is desquamation of epithelial cells in the terminal ducts accompanied by hyperplasia of the periacinar connective tissue. The ducts in this state may be distended, giving rise to a clinical picture which will be described subsequently. Whitehouse, on the other hand, takes issue with Cutler, and considers the condition pathological rather than physiological and prefers the term mastopathia, suggesting that the process is a breakdown in the physiological monthly drainage of the breast. Semb describes this condition as a fibromatosis mammæ with proliferation of the epithelium and connective tissue but without microscopically visible cyst formation. He believes this condition may be the precursor of subsequent cystic disease of the breast and that it is related to cyclic changes in the mammary epithelium and connective tissue described by Rosenburg and Dieckmann associated with the menstrual state. In contradistinction to this so-called physiological state is the occurrence of cysts and intracystic and intraductal papillomata which Cheatle considers pathological in the sense that they are true neoplastic formations and describes them under the term "cystiphorous desquamative epithelial hyperplasia." Macroscopically, the appearance of the cut breast depends upon the extent of the disease which may be diffuse or localized. The cysts may vary in size from tiny, barely visible, pea-sized nodules to single or multiple cysts of lemon size or larger. The cysts when unopened and exposed during the course of extirpation may be bluish in color which caused Bloodgood to call them "blue-domed cysts." The larger cysts are usually acinar in origin with smooth walls. They are usually multiple although they may be single. The smaller

cysts are ductal. The fluid contents vary. It may be clear, chocolate-colored or inspissated, the appearance being that of putty. In the acini the first change from the normal epithelium is an elongation of the cells with a peculiar pallor which has earned for them the term pale cells or pale epithelium first described by Borst and Wohlsecher. These pale cells may increase in number, desquamate and distend the acini causing the formation of small cysts. The acinar walls may subsequently disappear forming the larger type of cysts lined by flattened epithelial cells. These are the cysts previously mentioned as the blue-domed cysts of Bloodgood. As for the etiology of this condition there are four main theories. The first that the condition is inflammatory causing an obstruction in the duct brought about by proliferating connective tissue or epithelial débris. The second that the condition is caused by epithelial hyperplasia without the necessity of the above-mentioned factors. Thirdly, that the pathogenesis is based upon a developmental defect, and lastly, that we are dealing with a neoplastic process on the basis of primary epithelial proliferation (Küchens). Cysts may undergo certain changes which are of paramount importance in connection with the clinical features of this condition. Particularly in the smaller ones as opposed to the larger confluent ones the epithelial lining of the cysts seems to possess power to proliferate and to assume as Cheatle and Cutler believed a true epithelial neoplastic state. It is questionable whether papilloma and cystic disease of the breast can be separated as distinct and separate clinical entities. Many authors feel that the former is simply an advanced stage of the latter and should therefore be grouped together. The condition is usually limited to a duct or to one of its branches. The papillomatous growths may be multi- or uniradicular situated just beneath the nipple, or deeply in the breast tissue. In the former location they frequently give rise to a serohæmorrhagic or hæmorrhagic discharge from the nipple which will be discussed more fully under symptomatology. It should be emphasized here that reference has already been made to the slender papillomatous excrescences which appear in dilated acini; these usually remain microscopic or may disappear. Rarely an acinus is the seat of a papillomatosis in conjunction with a similar process in its terminal duct or in the main branch of a duct. In intraductal papilloma the epithelial hyperplasia may exist in the duct just beneath the nipple in the ampulla or in the main branch before it divides. It may on the other hand extend throughout the entire course of the duct and involve the acini to the extent that they all contain the proliferated epithelial cells. Various terms have been applied to this lesion among which are: villous papilloma, duct papilloma, cystadenoma and papillary cystadenoma.

Relationship to Carcinoma.—The relationship of the cystic breast to carcinoma is of the greatest theoretical and practical importance. Perhaps in no other field in the clinic and laboratory have more divergent views been expressed and more tedious work been done to shed light upon this intricate problem. It is needless to say that our therapeusis is based in a large measure upon this point. There is a great deal of variance in statistical

figures in support of the contention that the cystic breast is a precancerous lesion. Tietze estimated that about 10 per cent. of breasts the seat of cystic mastitis develop carcinoma. Speese estimated 15 per cent. in a series of 295 collected cases. Semb estimated that 24 per cent. of the cases eventuate in carcinoma, particularly those with papilloma formation. The so-called precancerous state has been particularly emphasized by Cheatle and Cutler who estimate that in 20 per cent. of the cases this lesion results in carcinoma. These conclusions vary with the different publications and this difference of opinion is to be explained on the basis that as yet we have no definite criteria upon which to base the first transition from a benign to a malignant process and each observer's diagnosis is therefore merely a personal one. Investigations undertaken to determine the presence of the cystic state in well-developed carcinoma of the breast also show no unanimity of opinion. MacCarty and Keynes report 80 per cent. of such breasts involved; Thompson, 33 per cent.; W. Fischer, 14 per cent.; and Ewing, 50 per cent. In this connection borderline breast lesions, particularly those falling in the group of cystadenocarcinomata and intraductal papillary carcinoma, present an interesting problem to the pathologist who guides the surgeon in his indications. The question of cell irregularity, penetration of the basement membrane, and the presence or absence of mitoses will enter into this decision. Bloodgood in this connection has emphasized the clinical fact that where pathologists disagree as to the assured malignity of a breast tumor the patient following a radical procedure does extremely well as opposed to those sufferers of carcinoma of the breast in which there is no question clinically and pathologically as to the diagnosis.

Clinical Picture.—Pain is subjectively the most important symptom. It may appear as a sense of soreness or as a feeling of discomfort or tenderness. The pain is usually confined to the breast or may extend to the arm of the same side. In the state of mastopathia, mazoplasia or fibro-adenomatosis, pain may be especially accentuated just before the menstrual period. Upon palpation the mammary gland is firmer than normal. There may be an unevenness of its anterior surface due to an increased amount of fibrous connective tissue that extends into the suspensory ligaments of Sir Astley Cooper. In this state secretion from the nipple is rarely or ever encountered. This benign condition occurs at an earlier age period usually between twenty and thirty years as opposed to the well-developed cystic breast condition. In the cystic state the clinical picture will vary with (1) the multiplicity or singleness of the cysts; (2) the presence or absence of intracystic or intraductal epithelial proliferation. In the former the single cyst will present a localized tumefaction with its wall smooth and sharply defined. When very tense and deeply situated it may be difficult to distinguish from carcinoma upon palpation. The tumor is not adherent to the skin or underlying structures and the nipple not retracted. Unless infection has become superimposed, the axillary glands are not enlarged. In the multicystic variety of the lesion some of the cysts may have become of sufficient size to produce a tumefaction readily palpable in addition to which the remainder of the breast may appear uni-

formly nodular. In this state the condition may be bilateral. With the advent of intracystic and intraductal epithelial proliferation, discharge from the nipple becomes a frequent and important diagnostic sign. This may be serous or serohæmorrhagic, spontaneous or induced by gentle massage in the direction of the nipple. Its production may be limited to a sector of the breast containing the intraductal lesion or if the disease is widespread may be elicited from various quadrants of the palpated mamma. Its prognostic and clinical significance has been variously estimated and many references in the literature, only a few of which will be reviewed here, attest to the interest this sign has evoked in clinicians and pathologists. Adair in 1930 reporting upon 108 cases exhibiting this sign found about one-half of the cases to have benign lesions whereas the other half were malignant. These deductions correspond closely to those reported by Miller and Lewis and Judd. Klose maintains the bleeding to be a symptom of a cancerous or a precancerous condition which should be dealt with radically. Erdheim, Deaver and MacFarland, and Bloodgood on the other hand believe that the presence of a serohæmorrhagic or hæmorrhagic discharge from the nipple is much more often associated with a benign than a malignant lesion. Hart reviewing the material from Johns Hopkins Hospital laboratory emphasizes the necessity of careful microscopical examination of the diseased tissue in these cases and stresses the usually evident signs of cancer, as demonstrated by a palpably characteristic tumor in those cases which are malignant. In a series of cases which I have collected from the wards and private records of some of the surgeons of Mount Sinai Hospital which forms the basis of this study comprising a ten-year interval, bleeding from the nipple occurred in twenty of 226 cases of cystic disease of the breast, an incidence of about 8 per cent. This is slightly higher than that reported by Semb, Miller, and Lewis who found bleeding in 5.8 per cent., 5.7 per cent. respectively in a series comprising 608 and 700 breast lesions including carcinoma. In addition there were 13 cases which presented a serous or seropurulent discharge from the nipple. I have not estimated the number of cases of cancer of the breast presenting this sign during the same period of time but in a review of breast cancer published in 1926, Moschcowitz, Colp and myself estimated the cases of benign bleeding to be distinctly larger than those presenting a malignant lesion. I have no doubt that some of the cases presenting a history of bleeding from the nipple would not be so classified today on the basis of a microscopical examination of the material expressed. In some cases undoubtedly the material consisted of duct secretions of the chocolate-colored type. Pathologically these cases presented the following lesions. Nine had intraductal papillomas; two papillary and cyst papillary adenomas; two early proliferative changes in the duct epithelium; four periductal fibrosis with duct dilatation; two are reported as cases of chronic cystic mastitis without mention of any accompanying proliferation, and in one case the pathological report was omitted. The type of operation that was done in this group and the follow-up data will be included in that of the whole group which will be summarized subsequently.

Differential Diagnosis.—In distinguishing the various phases of the

cystic breast from other lesions which we are called upon to differentiate, the distinguishing features depend for the most part to what state of development the lesion has progressed before the patient presents herself for treatment. In the fibro-adenomatous or mazoplastic state the conditions most commonly to be distinguished are: (1) early generalized and localized cystic states of the breast; (2) very rarely a diffuse carcinoma. In pure cystic disease, localized or diffuse nodularity of the breast without discharge of blood or serum from the nipple and without the characteristic signs of carcinoma can usually be relied upon to make the diagnosis. In some cases the condition will have to be differentiated from a galactocele and a cystic adenoma. With the advent of papilloma formation with bleeding and serohæmorrhagic discharge from the nipple, differential diagnosis between the benign and the malignant lesion is essential. Localized tumefaction and the hardness of carcinoma is usually sufficient to make the examiner suspicious of its presence although at times it can only be confirmed by biopsy and microscopical examination of the excised specimen. Transillumination as advised by Cutler is a very valuable addition to our diagnostic armamentarium. In cystic conditions uncomplicated by papilloma formation the lesion is translucent whereas in carcinoma or intraductal papilloma the lesion will be found to be opaque.

In a condition which has, as already stated, been the cause for so much difference of opinion in respect to its etiology, nature, life history, significance and prognostic import, it is little wonder that this difference of opinion should be particularly emphasized in the surgical treatment of this condition. Various factors have made this the case; firstly, the life history is not definitely known; secondly, lesions in all stages of development have been examined with the result that judgment predicated upon early phases must of necessity be different from those formulated upon later and more maturely developed ones; thirdly, a great deal of the investigations have been conducted by pathologists rather than by clinicians, and fourthly, there is a paucity of follow-up results in the literature with particular reference to any well-recognized or formulated plan of surgical treatment. Unquestionably complete mastectomies have been done for localized benign lesions of the breast under the assumption that the lesion was cancerous or precancerous where a more conservative procedure would have sufficed to eradicate the disease. It was with the purpose of attempting to learn the results of conservatively treated breast lesions of this type that this study was undertaken.

TABLE 1

Age Group and Marital Status of 226 Cases

Age	Married	Single
10–20 (3)	0	3
20–30 (13)	7	6
30–40 (65)	53	12
40–50 (107)	98	9
50–60 (25)	25	0
60–70 (13)	13	0

The pathological lesion was classified as follows in those cases in which a report is available. Chronic cystic mastitis was diagnosed seventy-four times; in conjunction with dilatation of ducts, eighteen times; intraductal papillomas, sixteen times; cystic mastitis with intraductal papilloma or papillary adenoma, twelve times; simple cyst, forty times and papillary cystadenoma, five times. Of the entire group fifty patients had complete mastectomies because the lesion was widespread or the suspicious nature of the tissue removed warranted this procedure. Three patients had both breasts removed for diffuse bilateral disease; two of them at different time intervals, the other simultaneously. I have been able to collect follow-up data on fifty-four patients upon whom partial breast excision was done. (Table II.)

TABLE II

7 patients	followed	11 years
4 patients	followed	10 years
6 patients	followed	9 years
2 patients	followed	8 years
3 patients	followed	7 years
6 patients	followed	6 years
8 patients	followed	5 years
7 patients	followed	4 years
5 patients	followed	3 years
6 patients	followed	2 years

Two patients of this group are of particular interest; the first of these a forty-two-year-old woman who had a local excision of a breast lesion in 1923 which was considered benign. In 1930 another cyst from the same breast was removed and diagnosed as a cystadenocarcinoma. She is well at present following a radical mastectomy. The second is a case of great interest in that the patient, a woman of forty-four years was first seen and operated upon in 1930 for a chronic mastitis of the left breast, at which time a local excision was done; in 1931 she had a similar procedure for chronic cystic mastitis of the right breast. She is now attending New York Cancer Institute following a bilateral mastectomy for carcinoma performed at the Metropolitan Hospital in 1932. She has involvement of the cervical spine and supraclavicular lymph-nodes. With these two exceptions I am not aware of any patient who first presented herself with a benign breast lesion returning later with carcinoma. In two cases patients who had previously been operated upon for carcinoma of the breast returned for a local excision of a benign cystic lesion of the other breast; one of these patients has been heard from and is well. Of the patients followed eleven had multiple operations for recurrent cystic disease; one of these has had four local excisions up to date. Her disease is bilateral and has necessitated a simple mastectomy upon one occasion. Of the entire group of patients including those not followed thirty-four had multiple operations for cystic disease. Greenough and Simmons reporting upon eighty-three cases of cystic disease of the breast treated by local operation, excluding papillary cystadenoma, found cancer to develop in 4.8 per cent. In those patients we have been able to follow the number

developing carcinoma is 3.8 per cent. Of the patients with a serohæmorrhagic discharge from the nipple who were operated upon conservatively we have been able to obtain a follow-up on five, the longest for a period of eight years without recurrence of the bleeding. In one case a serohæmorrhagic discharge developed in the other breast. Semb reports two cases of cancer developing following local operations for cystic disease. His material for the most part was subjected to complete removal of the breast so that his proportion is higher than that published by Greenough or found by me. Bloodgood has found only three instances of cancer following local excision of a chronic cystic lesion in 128 cases. To quote Bloodgood: "The development of cancer in the breast after the removal of a zone of the breast the seat of chronic cystic mastitis is apparently not more frequent than the normal incidence of cancer in the same number of women at the same age who had not been operated upon; three out of 128 cases—about 2 per cent."

SUMMARY.—(1) The clinical and pathological problems of the cystic breast are discussed with the view to outlining a therapeutic rational which will prevent a mutilating operation when unnecessary and at the same time protect a patient against recurrence or the development of cancer.

(2) For this purpose a series of cystic breast cases are reviewed and discussed.

(3) In the condition of fibrosis mammæ operation is contra-indicated and the administration of ovarian hormone as advocated by Cutler and Howard C. Taylor, Jr., should be employed.

(4) In localized cystic disease (the blue-domed cyst) local excision is all that is indicated.

(5) The extent of the lesion may necessitate mastectomy.

(6) The follow-up although by no means complete seems to agree with publications of a similar nature; namely, that in those patients operated upon conservatively the incidence of cancer does not seem to be any larger than for a similar age group.

CONCLUSION.—While cystic disease of the breast should be considered a distinctly pathological process it need not, under the careful scrutiny of an experienced pathologist and clinician, necessitate the sacrifice of the breast.

BRACHIAL PLEXUS BLOCK ANÆSTHESIA *†

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Brachial plexus block anæsthesia for operations on the upper extremity has not become popular in this country. In 1927, Livingston and Wertheim[1] noted that the Cumulative Index had not reported a single article of American origin on this subject. Since then very few have been added. Many of the standard text-books on surgery barely mention the method, leaving the reader to form his own conclusions as to its merits.

Spinal anæsthesia, slow to make progress, has become more popular with an increasing number of indications in the past ten years. In selected cases it is the anæsthetic of choice for operations on the lower extremity. It is not applicable to the upper extremity for success requires anæsthesia of the lower cervical cord. With possible danger of higher diffusion and involvement of the phrenic nerve and medulla, the limit of safety is too narrow to warrant its use.

The closest analogy to spinal anæsthesia for operations on the lower extremity is brachial block anæsthesia for operations on the upper extremity. Instead of being blocked within the spinal canal, the nerves to the upper extremity are anæsthetized after they emerge from their respective intervertebral foramina and converge to form the brachial plexus.

As in spinal anæsthesia, there are certain dangers and technical difficulties in brachial block anæsthesia, but these can be largely overcome, leaving a wide margin of safety and making the procedure comparatively simple. It can be used for a variety of conditions, and its contra-indications are fewer than in spinal anæsthesia. As contrasted with the latter in which there is controversy as to its safety in hypertension and certain cardiopathies, brachial block anæsthesia seems indicated in these conditions, but should necessarily be used with caution and respect. Since the drug is not injected into the spinal canal, it does not carry with it the dangers of spinal anæsthesia, and therefore has a wider range of usefulness.

History.—Although Crile formerly exposed the nerves of the brachial plexus to anæsthetize them directly,[2] Hirschel[3] was the first to report on injection through the skin without direct exposure to produce anæsthesia of the entire upper extremity. This was an impossibility before the introduction of adrenalin, which prevents diffusion of the anæsthetic agent before its fixa-

* Experimental injections and neck dissections made under supervision of Dr. Oscar V. Batson, Department of Anatomy. Cases from the surgical service of Dr. John B. Carnett, Graduate Hospital, University of Pennsylvania. Under Endowment Fund of the Diagnostic Hospital.

† Thesis submitted to the Faculty of Surgery of the Graduate School of Medicine of the University of Pennsylvania in partial fulfillment of the requirements for the degree of Master of Medical Science [M.Sc. (Med.)] for graduate work in Surgery.

tion to the large nerves. He employed the axillary route and used adrenalin in the novocaine solution. In 1911, Kulenkampff[4] reported successful supraclavicular injections of the brachial plexus in the region of the first rib. His technic is now generally accepted as having the most advantages and fewest disadvantages. Babitzki[5] pointed out that the plexus is accessible below the clavicle, but merely recommended this approach as an alternative in case the supraclavicular method is not feasible. Kappis employed the paravertebral route, necessitating several injections.[6] Attempting to minimize the danger of puncturing the pleura, which exists when injecting in the region of the first rib, Mulley[7] chose a site higher in the neck.

Anatomy.—Although there may be numerous variations, the brachial plexus,[8] as a rule, is made up of the anterior primary divisions of the four lower cervical nerves and the greater part of the first thoracic nerve. Occasionally, branches are supplied from the fourth cervical and second thoracic nerves. After emerging from their respective intervertebral foramina, they converge toward the upper border of the first rib, uniting to form three trunks. The anterior primary divisions of the fifth and sixth cervical nerves form the upper trunk, the seventh cervical continues as the middle trunk, while the eighth cervical and first thoracic unite to form the lower trunk. (Fig. 1.)

Just before these trunks are formed, the anterior primary divisions of the fifth and sixth cervical nerves each receive a gray ramus communicans from the middle cervical sympathetic ganglion, while those of the seventh and eighth nerves each receive a gray ramus communicans from the inferior cervical sympathetic ganglion. The anterior primary division of the first thoracic nerve is connected by two rami communicantes with the first thoracic sympathetic ganglion.

Each of these trunks divides into an anterior and posterior branch preliminary to forming three cords. The anterior branches of the upper and middle trunks form the lateral cord. The anterior branch of the lower trunk forms the medial cord, while the posterior branches of all trunks form the posterior cord. The terms, lateral, medial and posterior, designate the relation of the three cords to the subclavian artery.

From these cords are derived the five major nerves of the upper extremity. The lateral cord divides into the musculocutaneous nerve and the lateral head of the median nerve. The medial cord divides into the ulnar nerve and the medial head of the median nerve, while the posterior cord divides into the radial and axillary nerves. The remaining nerves of the entire upper extremity which are not branches of the five major nerves have their origins from other places in the plexus with two exceptions. The intercostobrachial nerve, supplying the skin of the inner side of the arm, is derived from the second thoracic nerve, and does not enter into the brachial plexus, while the skin over the upper arm and shoulder is innervated by the supraclavicular nerves arising from the cervical plexus.

As the trunks of the plexus cross the first rib at about its middle third,

FIG. 1.—A common form of brachial plexus. (From Morris' Anatomy.)

FIG. 2.—Dissection of neck, showing the anatomy in the region of the first rib. The plexus and the subclavian artery are posterior to the scalenus anticus muscle, while the subclavian vein is anterior to it. The external jugular vein has been removed. The arrow points to the plexus and the site of injection.

they emerge between the scalenus anticus and scalenus medius muscles which insert on the first rib. (Figs. 2, 3 and 4.) The former arises from the transverse processes of the fourth, fifth and sixth cervical vertebræ, while the latter takes origin from the transverse processes of the lower six cervical vertebræ. Near their insertions the plexus is in close relationship with the subclavian artery, the latter also emerging between the two scalene muscles, while the subclavian vein lies anterior to the scalenus anticus muscle, and is thus separated from the plexus and artery. After crossing the first rib, the plexus passes beneath the clavicle at about its middle third, and enters the axilla where, at the lower border of the pectoralis minor muscle, each of its three cords divides into its terminal branches.

In the posterior triangle as it emerges between the two scalene muscles and passes over the first rib, the plexus is covered superficially by the skin, superficial fascia, platysma, and deep fascia. It is crossed by the lower part of the external jugular vein, the transverse cervical vein, the transverse scapular vein, the posterior belly of the omohyoid muscle, and the transverse cervical artery. There may be wide variations of the veins in this region.

The first rib is inclined slightly downward and outward, its forward inclination varying approximately from an angle of 15° to 30° with the horizontal, depending upon the build of the individual. It passes beneath the junction of the inner and middle thirds of the clavicle. At the inner side of the rib the dome of the pleura rises somewhat above it.

In locating the plexus with a needle, therefore, the most important structures to avoid are: the external jugular vein, the subclavian artery, and the dome of the pleura. There seems only remote danger of injury to the subclavian vein because it lies anterior to the scalenus anticus muscle and well under the clavicle.

In practically all individuals, the external jugular vein, running from the angle of the mandible to the mid-point of the clavicle, can be demonstrated by having the patient blow out his cheeks. In the majority of individuals the subclavian artery can be palpated where it crosses the first rib. Difficulty may be encountered in an obese person with a thick neck, but the approximate location of the artery is determined by the point at which pressure causes diminution or absence of the radial pulse. In thin persons the brachial plexus itself can be felt, and definite paræsthesia elicited by pressing upon it or rolling it under the fingers. The first rib is not always palpable, but when it can be felt, together with the artery and plexus, the technic of injection is comparatively simple. In fat individuals, where none of these structures are definitely palpable, more care in technic is necessary.

Technic of Injection.—A pre-operative sedative is given one-half to one hour before injection. Morphine or a barbiturate is preferable.

Kulenkampff has discontinued the use of the sitting posture because of occasional giddiness and faintness.[9] The patient lies flat on his back, head to the opposite side from injection, with a small folded sheet or a sandbag under

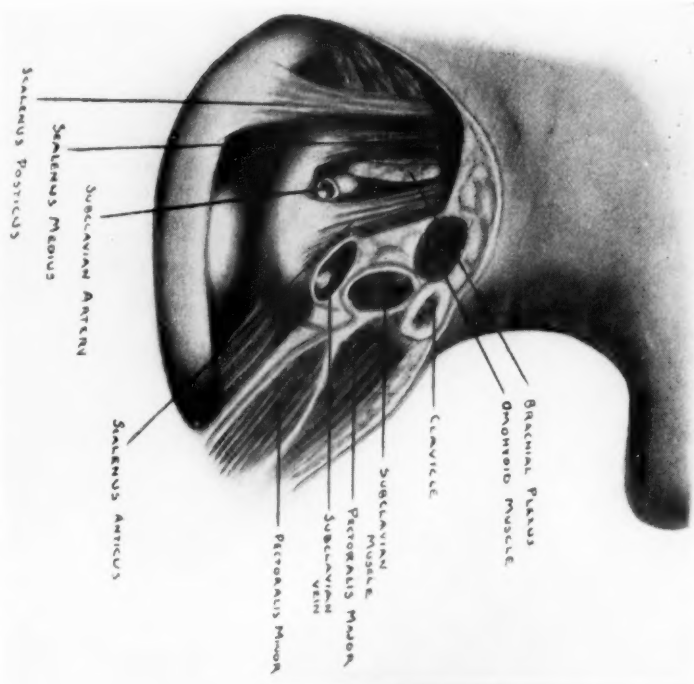

FIG. 3.—Lateral aspect of first and second ribs, showing relations to adjacent structures. (Modified from Callander Surgical Anatomy.)

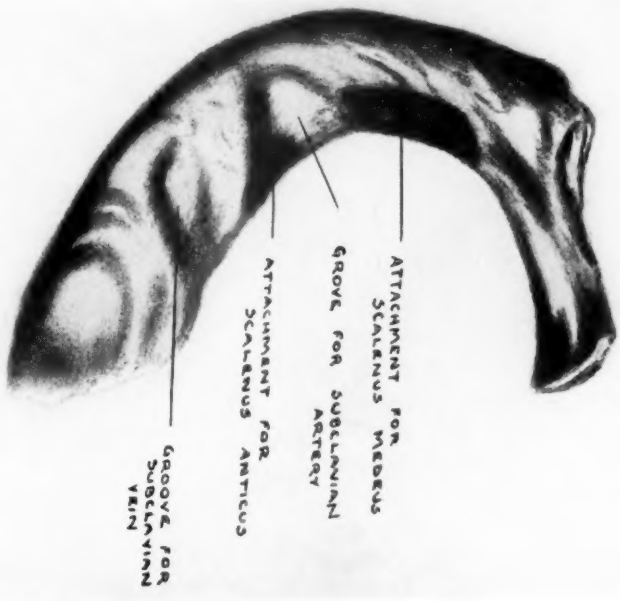
Attachment for Scalenus Medius
Groove for Subclavian Artery
Attachment for Scalenus Anticus
Groove for Subclavian Vein

FIG. 4.—Superior surface of first rib, showing sites of attachment for scalenus anticus and medius muscles, and grooves for subclavian vein and artery. (From Morris' Anatomy.)

the neck. The shoulder is depressed as much as possible with the arm by the side of the body.

The entire supraclavicular and infraclavicular areas are prepared with iodine and alcohol. The mid-point of the clavicle is determined, and then an attempt is made to visualize the external jugular vein and to locate the first rib, the subclavian artery, and the brachial plexus. If both the plexus and artery can be felt, the latter is retracted beneath the clavicle by the forefinger. (Fig. 5.) A wheal of novocaine-adrenalin solution is raised about one or two centimetres above the mid-point of the clavicle, or a trifle medially or laterally to avoid the external jugular vein. From this point a small-calibred needle

FIG. 5.—A wheal is made about 2.5 centimetres above clavicle (outlined) at its mid-point. If the external jugular vein is at this point, the wheal is made either lateral or medial to it.

FIG. 6.—Through the wheal the needle is introduced inward, downward, and backward to strike the first rib while the right forefinger guards the subclavian artery. If paræsthesia is not obtained, further manipulation of needle is necessary (Fig. 7).

about five centimetres in length, detached from the syringe, is introduced inward, downward, and backward to strike the first rib in the region of the plexus. (Fig. 6.) The patient has previously been warned of paræsthesia, and when this is obtained, aspiration is made to make certain that the needle is not in a vessel before injecting fifteen to thirty cubic centimetres of fresh, 2 per cent. novocaine-adrenalin solution in this region. (Figs. 7 and 8.) The entire amount of solution may be deposited at one time if paræsthesia is prominent, while in other cases it seems better to inject five to ten cubic centimetres at the deeper level, then withdraw the needle a few millimetres, aspirate, and again inject. Thus the solution may be placed in two or three levels. Occasionally, the patient's complaint of increased pain down the arm while the solution is being injected indicates that the needle is in the proper place. If paræsthesia is produced by the introduction of the needle, or the injection of the solution, anæsthesia is practically assured, provided there is no change in the location of the needle tip before injection is completed. If

paræsthesia has not been obtained, the needle is withdrawn until nearly out of the skin, then reintroduced, still aiming to hit the first rib, but a little anteriorly (toward the sternal end of the rib) or posteriorly (toward the vertebral end of the rib) as the case may be. Usually the needle is introduced too far posteriorly at first, and needs to be worked gradually forward, toward the sternum, until the patient complains of a sharp, sudden pain radiating to the tips of the fingers. At other times the pain is not so intense because of the pre-operative sedative or severity of preëxisting pain.

If the patient is a heavy individual and the anatomical structures cannot be palpated or definitely located, it is best to proceed accurately according to Kulenkampff's original technic, except that the patient lies in the position above described. The needle is introduced through the skin as before, direct-

FIG. 7.—The needle is withdrawn slightly, and is re-introduced to strike the first rib nearer its anterior end. In this patient, definite paræsthesia has been produced, and the needle is in the proper position for injection.

FIG. 8.—The syringe is attached. If the aspiration fails to obtain blood, fifteen to thirty cubic centimetres of the novocaine-adrenalin solution are injected.

ing it inward, downward, and backward toward the spinous process of the second or third dorsal vertebra. This direction locates the first rib, and occasionally the plexus, but more often the needle must be partially withdrawn and re-inserted to strike the rib more anteriorly before paræsthesia is obtained. Aspiration and injection are made as before.

Rarely, paræsthesia cannot be elicited. In this event, Labat recommends injection in several places: ten cubic centimetres of the 2 per cent. solution beneath the deep fascia in the direction of the first rib; five cubic centimetres in the region of the tubercle of Chassaignac (transverse process of the sixth cervical vertebra); finally, five cubic centimetres at the lateral margin of the first rib, behind the clavicle. The regions are lightly massaged to hasten diffusion of the injected fluid.

If the injection is made correctly, the patient usually feels that the extrem-

ity is a bit warmer, due to vasodilatation. This sensation comes on immediately and gradually leaves as anæsthesia develops. The latter begins in two to five minutes, being complete in fifteen to thirty minutes. There is experienced a heavy feeling of the extremity, gradually developing into a paresis

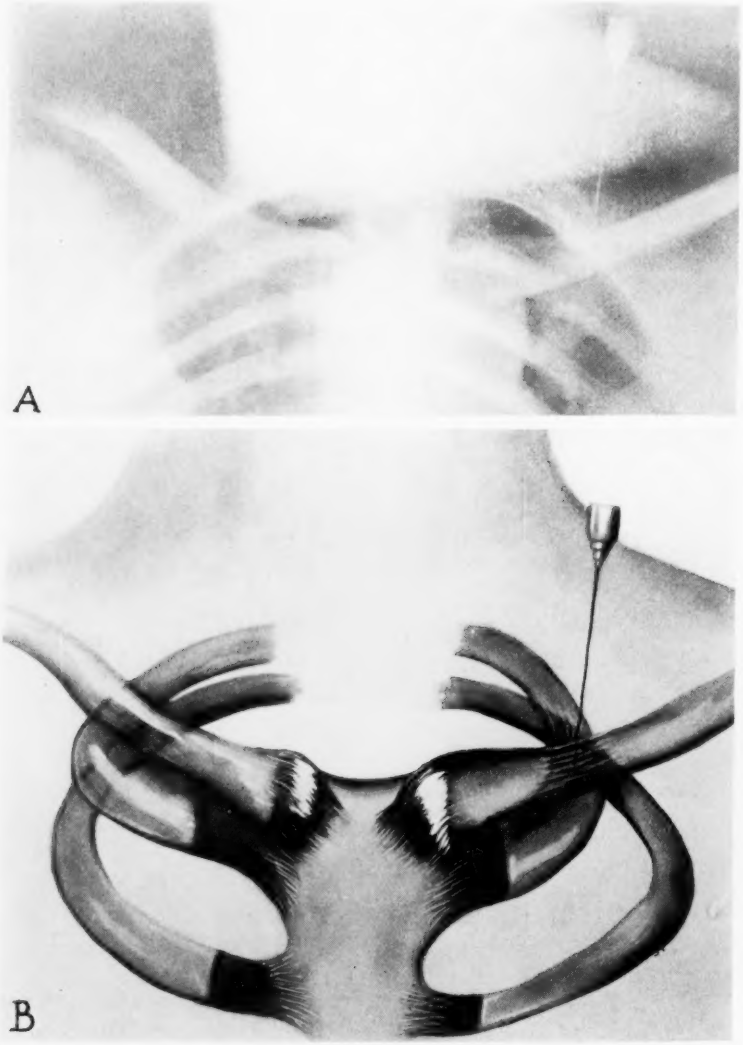

FIG. 9.—(A) Needle touching first rib in correct position for injection, definite paræsthesia having been produced. In this thin woman about two centimetres of the five centimetre needle is beneath the skin. (B) Drawing from above röntgenogram.

or often a complete motor paralysis of the arm and forearm. Pain is one of the first sensations to leave, while touch is the last. Anæsthesia may be perfect for surgical procedures, while slight touch sensation may still be present. The average duration of motor and sensory paralysis is one and one-half to two hours.

Frequently the ulnar side of the hand and forearm becomes anæsthetic before the radial side. Five to fifteen minutes may elapse between the appearance of anæsthesia of the two nerve distributions, but occasionally the former may be the only part of the extremity involved. In these cases only a portion of the plexus has been blocked, due to infiltration of the solution in or around a single cord resulting from injection too far posteriorly toward the spine.

When injection is perfect, there is not complete anæsthesia of the shoulder and arm. The supraclavicular nerves from the cervical plexus supply the skin over the shoulder, and the intercostobrachial nerve, which originates from the second thoracic nerve, supplies the skin of the inner aspect of the arm and the axilla. If open operation is attempted about the shoulder-joint or upper arm, these nerves must be blocked or local infiltration made. This is not necessary, however, in closed reduction of a dislocated shoulder or fracture of the humerus.

Failures.—Excluding the original work of Kulenkampff, absolute failures to obtain anæsthesia did not exceed 7 per cent., while the average failure was 2.7 per cent., and decreases considerably with the experience of the surgeon.[1] These figures vary with each surgeon. Inspiration for this paper came after failures to obtain anæsthesia in my first three cases. After thorough investigation and study of this method there has been no absolute failure with only a small percentage of partial failures, none of which required an additional anæsthetic to complete the surgical procedure.

Failures are due to a variety of conditions: (1) The solution should be a fresh, isotonic, 2 per cent. novocaine solution containing 5 to 8 minims adrenalin solution (1:1000) to one ounce. Fifteen to thirty cubic centimetres of this are used. According to Braun, brachial block anæsthesia was an impossibility before the introduction of adrenalin. Without it the novocaine is carried away quickly and is not allowed to become fixed to the large nerves of the plexus. In the three failures previously mentioned adrenalin was not used.

(2) Fear of striking the subclavian artery has the tendency to make one inject too far posteriorly, toward the spine. Kulenkampff recognized this and attempted to show that no harm results from striking the artery with a small-calibred needle. For demonstration purposes to his students on occasions he would deliberately strike the artery. The needle should first be tested to see that its lumen is patent, then examined to see that its point is not bent or hook-shaped. If the artery is punctured, bright blood appears, and the needle is withdrawn. Pressure is applied over that area for a short time, and the needle is re-inserted more posteriorly until paræsthesia is obtained. In my limited experience of seven cases in which the artery has been struck, there has been no evidence of ecchymosis or hæmatoma resulting.

(3) Coöperation of the patient is essential. To avoid apprehension, a pre-operative sedative should be given. An apprehensive patient is prone to jerk away from the needle when paræsthesia is obtained, even though he

has been carefully warned to expect the sensation. For this reason, injection is best not made on a child or one who does not understand what is being attempted.

(4) Paræsthesia should be obtained before injection is made. Kulenkampff, as well as Labat, stresses this point. But after reasonable and unsuccessful attempts to obtain paræsthesia, the latter advises injection in several places as previously mentioned. Livingston and Wertheim, however, advise against seeking paræsthesia, feeling that contact with the nerves predisposes to after-effects. According to them, with a sharp, small-calibred, short-beveled needle, one can distinctly feel the puncture of the deep cervical fascia, beneath which lies the plexus. Injection beneath this fascia and in the area between the anterior and middle scalene muscles will give anæsthesia. This, however, seems more theoretical than practical. Failures and poor anæsthesia occur most frequently in those patients in whom paræsthesia is not obtained. On the other hand, complete anæsthesias are nearly always assured when paræsthesia is produced, provided the needle tip does not move before the injection is complete. In some cases a smaller amount of solution than usual may be used if paræsthesia is particularly striking.

On making ten injections on cadavers with one to two cubic centimetres of dye, then exposing the plexus, it was found that in only four had the dye been deposited close enough to the plexus to produce anæsthesia had the subject been living. In all cases the needle had been introduced about 2.5 centimetres above the mid-point of the clavicle and directed toward the spine of the second or third dorsal vertebra. In most cases the injection had been made too far posteriorly. The amount of dye used was smaller in quantity than the solution used in brachial plexus block, but it was demonstrated that the point of the needle was occasionally as far as three centimetres away from the plexus. Directing the needle toward the spinous process of the second or third dorsal vertebra does only one thing accurately, it locates the first rib which protects the pleura. There are too many factors involved to get a constant relationship of the brachial plexus to the first rib, clavicle, and spinous process of the second or third dorsal vertebra. In other words, this relationship varies with the type of build of the individual—fat or thin, square-shouldered or sloping-shouldered, erect or stooping. To locate the plexus accurately, therefore, paræsthesia should be sought.

A mistake is sometimes made in thinking paræsthesia is obtained. The patient may say he feels pain over the whole shoulder, but further search should be made until he complains of definite sharp pain radiating down to the tips of the fingers. Usually this latter sensation is so striking that there is no doubt in the surgeon's mind that the needle is in the proper position.

(5) Injection into a small vessel, according to Livingston and Wertheim, may carry the anæsthetic away rather rapidly, resulting in poor anæsthesia and a serious toxic effect. To prevent this accident, aspiration is always done before injection is made. Even though the solution is not injected into a vessel, it is necessary to add adrenalin solution (1:1000), to allow fixation

of the novocaine before it is carried away by the lymphatics. Five to eight minims of adrenalin solution to the ounce of novocaine is sufficient.

Secondary Effects.—Sympathetic paralysis occurs occasionally, and is manifested by contraction of the pupil, flushing of one-half of the face, and hyperæmia of the conjunctiva on the side of injection. These symptoms disappear as the anæsthesia wears off, and have little significance. More rarely, evidence of irritation of the sympathetic chain is present, producing dilatation of the pupil on the side of injection.

Hartel and Keppler[10] showed by Röntgen-ray that phrenic nerve paralysis was a regular accompaniment of brachial block anæsthesia. They, therefore, advised against bilateral injection. However, in several of our cases not checked by Röntgen-rays in which injection had been made on the right side and excellent anæsthesia produced, it was possible to demonstrate by percussion that the liver moved freely with respiration. Strode[11] saw no ill effects when he made a bilateral injection for amputation of both forearms.

Toxic, or systemic, symptoms occur in 30 per cent. of patients injected in the sitting position, while the percentage is considerably less if the patient is supine. These consist of tremor, palpitation, and flushing, while in other cases there is either subjective or objective "pounding" of the heart. Nausea and vomiting, usually transient, may occur. The patient should be watched carefully until all secondary symptoms have passed.

Either the novocaine or the adrenalin may account for some of the untoward effects. Novocaine,[12] particularly in those having an idiosyncrasy to the drug, is capable of causing a tendency to collapse, or in other cases, serious respiratory difficulties, followed by clonic convulsions. These symptoms may not appear for an hour, and are apparently prevented by administration of barbital, grains 5 or 10, one-half to one hour before the novocaine injection. Thus, another very important reason for giving a pre-operative sedative is to prevent a serious novocaine reaction. Apparently there has been no quick test devised that will determine an individual's idiosyncrasy to the drug.

Adrenalin, on the other hand, may rarely cause a sensation of weakness, a fine tremor of the hands, and a slight sense of apprehension. These usually pass off readily. In aged persons with feeble hearts, and in those subject to cardiac arhythmias, particularly during acute infections, adrenalin may induce a fatal ventricular fibrillation, or other serious cardiac disorder. Although dangerous effects of adrenalin may seldom be seen, it is necessary to be careful with its use in any of the above conditions.

The pleura has been punctured, causing a severe pneumothorax. Emphysema, resulting in death, has also been reported.[13] To avoid this danger, Capelle modified Hirschel's method, using the bicipetal groove of the humerus as a landmark for injection. Mulley injected higher in the neck, introducing the needle perpendicularly, and three fingers'-breadth above the clavicle. Kulenkampff believes this method is no less dangerous. Puncture of the pleura, *per se*, has little danger, but with an unattached needle pneumothorax may quickly result. Directing the needle from a point one or two centimetres

above the mid-point of the clavicle toward the spinous process of the second or third dorsal vertebra almost invariably strikes the first rib, thereby protecting the pleura.

A number of injuries to the nerves have been reported, but in only one instance is there evidence that the introduction of the needle, or injection, produced the symptoms of nerve injury. Hartel and Keppler reported a fracture of the forearm followed by paralysis of the radial and other nerves. Hirschel advises that those depending upon delicate manipulations, such as musicians, should best not be injected because of possible nerve injury.

A record of only one death from this anæsthesia is found.[13] Shortly after injection, emphysema appeared in the supraclavicular area, later in the region of the pectoral muscles. There was considerable respiratory difficulty until death two days later. At autopsy, there was extensive pneumothorax on the left with evidence that the needle had punctured the dome of the pleura and had penetrated the apex of the lung a few millimetres.

Advantages.—There are several advantages of this type of anæsthesia. As with block anæsthesia of any other part of the body, a limited area is affected. The patient is not exposed to certain dangers of general inhalation anæsthesia. From the economic standpoint, the method is decidedly cheaper. The drug itself is less expensive than other anæsthetic agents, while the services of a special anæsthetist are not necessary, as the surgeon himself acts in that capacity.

Besides these general advantages, there are others that are peculiar to brachial block anæsthesia. Because of the usual muscular relaxation, dislocations of the elbow and shoulder are easily reduced. Reduction of fractures, with or without fluoroscopical guidance, is satisfactorily done. When fractures are manipulated under the fluoroscope, there is less worry about the patient's condition than occurs when a general anæsthetic is being administered in the dark. When fluoroscopical guidance is not employed the reduction may be followed by an immediate röntgenogram. If the fragments are not in satisfactory position, further correction can be made without subjecting the patient to more anæsthesia. It is also of value in tendon suture because, although there is usually considerable muscular relaxation, the patient may be able to move his fingers or wrist a slight degree. However, without considerable muscular relaxation, tendon suture and the reduction of fractures or dislocations are quite difficult.

Disadvantages.—The disadvantages are few, but cannot be entirely ignored. A careful technic is necessary. The surgeon should have a thorough knowledge of the anatomy of the region of injection, and take care that the anæsthetic agent is injected into the proper place, or a great many failures and poor anæsthesias will occur. In spite of this, failures may happen, but the percentage is considerably reduced as the surgeon's familiarity with the method increases. All types of persons are not good subjects for this type of anæsthesia. The technic usually is not time-consuming. It requires little

more time to give a successful block than it does for a spinal anæsthesia, although surgical anæsthesia comes on a trifle later in the former.

Indications.—Labat states that brachial block anæsthesia is the method of choice for all major operations on the upper extremity, while Hertzler[14] believes its usefulness is limited to those cases with marked contra-indication to ether. It seems that it should have a position about mid-way between these points. Diabetics should have the benefit of this method, while cardiac, pulmonary, and renal diseases point toward its use. Patients with an arm lesion who object to general anæsthesia can be handled satisfactorily by brachial block. All coöperative adults are good subjects, and its use in them will be increased by surgeons familiar with the technic.

Contra-indications.—Any patient who is not able to coöperate with the surgeon should not be chosen for this type of anæsthesia. This applies particularly to children, drunken or mentally deficient patients, and apprehensive or highly excitable ones. By proper sedation, however, the latter can usually be anæsthetized satisfactorily. Obviously, pathology in the neighborhood of the brachial plexus may prevent its use. Hartel and Keppler believe it is contra-indicated in pulmonary affections because of paralysis of the diaphragm on the injected side. This is usually temporary, but they have shown that occasionally it may last for several hours. Although their work was quite thorough and convincing, they having checked up by röntgenograms and fluoroscopy, others have not found this phenomenon to be a regular accompaniment. In a considerable number of our cases, normal movement of the right side of the diaphragm (where the injection had been made on the right) has been demonstrated by clinical methods. The above authors also believe the method should not be used in chronic alcoholics, chronic intoxications of lead or arsenic, or those in weakened conditions. It is also not advised in any case in which the pathology involves any part of the brachial plexus or its main branches. Musicians, or others requiring delicate manipulations of the fingers, are best not injected, although, as previously stated, there is little evidence that the injection itself has produced any untoward effects relative to the nerves.

SUMMARY

(1) A study of a method of anæsthesia of the brachial plexus was undertaken because of its common use abroad and its uncommon use in this country.

(2) The anatomy of the brachial plexus with especial reference to its relation with the first rib, subclavian artery, and clavicle is discussed.

(3) The commonly used method of block anæsthesia of the brachial plexus is described.

(4) Failure, which occasionally occurs, is attributable to several factors, but by careful technic these can be avoided. Satisfactory anæsthesia depends on the care and experience of the surgeon.

REPORT OF CASES

No.	Age	Sex	Diagnosis	Quantity Injected* (Cubic Centimeters)	Anæsthesia	Motor Paralysis	Remarks
1	60	F.	Fracture humerus, left	30	None	None	Paræsthesia elicited. Adrenalin not used in solution
2	70	F.	Fracture humerus, left	30	None	None	Paræsthesia probably not produced. Artery struck; no ecchymosis or hæmatoma resulting. Adrenalin not used in solution
3	65	F.	Fracture radius, right	30	None	None	Poor paræsthesia. Adrenalin not used in solution. Artery struck; no ecchymosis or hæmatoma resulting
4	42	F.	Abscess region of left elbow, 8 months pregnant	30	Satisfactory	Incomplete	Skin incision painless, but deep pressure sensation remained
5	45	M.	Fracture both bones, right forearm	30	Excellent	Incomplete	Reduction without difficulty
6	54	M.	Dislocation of right shoulder	30	Excellent	Complete	Artery struck; no hæmatoma or ecchymosis resulting. Reduction without difficulty
7	44	F.	Fracture of olecranon process, left	30	Excellent	Complete	Open reduction
8	9	M.	Lacerated tendon, wrist, right	None			Child jerked away from needle when paræsthesia obtained. Became noncoöperative and no further attempt made. Tenorrhaphy under general anæsthesia
9	15	M.	Fracture, radius, right	20	Good	Incomplete	Anæsthesia chiefly on ulnar side, less on radial. Reduction without difficulty
10	64	M.	Lacerated tendons, right	30	Excellent	Complete	Tenorrhaphy without difficulty

10	64	M.	Lacerated tendons, right	30	Excellent	Complete	Tenorrhaphy without difficulty
11	?	?	Fracture radius, right	30	Excellent	Incomplete	Reduction without difficulty
12	45	F.	Fracture radius, left	30	Poor	Incomplete	Non-coöperative patient. Reduction accomplished without additional anæsthesia
13	70	F.	Fracture radius, right	30	Excellent	Complete	Patient apprehensive. Nauseated before injection. Vomited several times after injection. Considerable "pounding" of heart. Subclavian artery struck. No ecchymosis or hæmatoma resulting. Reduction without difficulty
14	45	M.	Lacerated tendons, left	15	Excellent	Incomplete	Slight "pounding" of heart for short time after injection. Tenorrhaphy without difficulty
15	28	F.	Tendon-sheath infection with palmar abscess, right	30	Excellent	Complete	Artery struck; no hæmatoma or ecchymosis resulting. Incision and drainage
16	28	F.	Secondary operation on above patient (Case 15)	15	Excellent	Incomplete	Right diaphragm appeared to move freely after injection. Further incision and drainage
17	47	M.	Dislocation shoulder, right	30	Excellent	Complete	Patient weighed 200 lbs. B.P., 170/110. Artery struck; no hæmatoma or ecchymosis resulting. B.P. after injection, 160/90. Sympathetic paralysis. Right diaphragm appeared to move freely after injection. Reduction without difficulty
18	20	M.	Dislocation shoulder, right	20	Excellent	Complete	Right diaphragm appeared to move freely after injection. Reduction without difficulty

REPORT OF CASES (*Concluded*)

No.	Age	Sex	Diagnosis	Quantity Injected* (Cubic Centimeters)	Anæsthesia	Motor Paralysis	Remarks
19	30	F.	Osteomyelitis, distal phalanx, left thumb	30	Excellent	Incomplete	Curettage and drainage of distal phalanx
20	50	M.	Old dislocation, right thumb (interphalangeal joint)	30	Poor	Incomplete	Open reduction. Skin incision painless, but considerable pain sensation about joint. No additional anæsthesia necessary
21	16	M.	Palmar abscess, right	30	Excellent	Incomplete	B.P. increased from normal to 160/50, remaining about one-half hour after injection. Considerable "pounding" of heart. Sympathetic paralysis. Artery struck; no hæmatoma or ecchymosis resulting. Right diaphragm appeared to move freely
22	43	M.	Lacerated tendons, wrist	30	?	None	Appeared to have excellent anæsthesia. Coöperated poorly and tendon repair difficult. Patient later diagnosed manic-depressive psychosis.
23	32	M.	Lacerated tendons, right forearm	30	Excellent	Complete	Right diaphragm appeared to move freely. Tenorrhaphy without difficulty
24	17	F.	Lacerated tendons, left hand	20	Excellent	Complete	Tenorrhaphy without difficulty

24	17	F.	Lacerated tendons, left hand	20	Excellent	Complete	Tenorrhaphy without difficulty. No secondary symptoms
25	37	M.	Fracture both bones forearm, right	25	Excellent	Incomplete	Reduction accomplished without difficulty. Under fluoroscope, right diaphragm was elevated and fixed
26	37	M.	Compound fracture of olecranon, left	30	Excellent	Incomplete	Open reduction without difficulty
27	41	M.	Extensive infection, hand and forearm, right	30	Excellent	Incomplete	Multiple incisions and drainage. Right diaphram appeared to move freely
28	32	F.	Fracture olecranon, left	30	Excellent	Incomplete	Open reduction without difficulty
			The Following Cases Have Been Added Since Thesis Submitted to Faculty				
29	31	M.	Laceration tendons, right forearm	30	Excellent	Incomplete	Some difficulty in obtaining good apposition for suture of one tendon because of incomplete motor paralysis. No secondary symptoms
30	49	M.	Dislocation left shoulder with fracture of greater tuberosity of humerus	30	Excellent	Complete	Reduction without difficulty. Left diaphragm moved freely under fluoroscope. No secondary symptoms
31	25	M.	Laceration tendon, left wrist	30	Excellent	Complete	Tenorrhaphy without difficulty. No secondary symptoms
32	40	F.	Tenosynovitis left hand	30	Excellent	Incomplete	Incision and drainage. No secondary symptoms
33	14	F.	Posterolateral dislocation of left elbow with fracture lateral epicondyle of humerus	15	Excellent	Complete	Reduction without difficulty. No secondary symptoms

* In the first part of this series, 8 minims of adrenalin solution (1 : 1000) to 30 cubic centimeters of 2 per cent. novocaine solution were used. In the latter part, the amount of adrenalin was reduced to 5 minims with a marked decrease in the degree of cardiac symptoms.

(5) There are few dangers involved, and the method is considered to have a wide margin of safety.

(6) The secondary effects are of little consequence.

(7) Besides the advantages of limiting the anæsthesia to a particular part of the body, the method is especially useful in the reduction of fractures and dislocations, and in tendon suture.

(8) The chief disadvantage is its occasional failure, but with the experienced this is rare.

(9) The method is especially indicated in coöperative adults for major operations on the upper extremity and in whom a general anæsthetic is inadvisable.

(10) There are certain contra-indications to its use, chiefly non-coöperative patients and pathology in the neighborhood of the plexus.

(11) A report of thirty-three cases is included.

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LUGOL'S SOLUTION IN ACUTE SECONDARY PAROTITIS

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Acute secondary parotitis is a rare but distressing complication which carries an unusually high mortality, especially when it follows a major surgical operation. The incidence of this complication in a series of cases reported by Pique[1] in 1907 was 0.03 per cent. Beckman[2] from The Mayo Clinic had an incidence of 0.04 per cent. Rankin and Palmer[3] in a series of 135 cases of operations on the colon and rectum had an incidence of 0.74 per cent.

Although an uncommon complication, it is a serious one according to the literature. In Paget's[4] classic series of seventy-seven cases in 1886, there was a mortality rate of 46 per cent. Blair and Padgett[5] in 1923 reported thirteen cases with a mortality rate of 53 per cent. A 50 per cent. mortality rate occurred at The Mayo Clinic in a series of fifty-eight cases. The literature, however, reveals the fact that many of the patients who died had a very serious operation or primary disease, which itself had a high mortality.

If suppuration of the gland occurs in acute secondary parotitis, it is a much more serious affair. The literature reveals that when open drainage was instituted, the mortality was approximately doubled. Suppuration usually occurs when the gland is enormously swollen and under considerable tension. It begins as small, discrete, deep-seated abscesses from pressure necrosis. Occasionally a deep abscess ruptures into the auditory canal before recognition. Incision of the gland at this stage invites mixed infection, results in ugly scars, and not infrequently injures the facial nerve. When once well developed, daily aspiration of these abscesses through a large caliber needle is desirable. It obviates some of these dangers mentioned and may make open drainage unnecessary. One of our cases was so treated with excellent results.

Treatment.—Until 1930 the treatment for this malady was symptomatic. Then Rankin and Palmer[3] reported twenty cases treated by the application of filtered radium packs over the gland. In this series two cases suppurated with one death. The radium was applied at the very onset of the involvement.

In 1932, Hobbs and Sneierson[6] reported fifteen cases of parotitis treated by repeated dilatation of Stenson's duct. Six of these cases were post-operative; seven were either primary or followed a minor illness, such as influenza; one followed mumps and one broncho-pneumonia. Out of this series there were four deaths. The cases that responded promptly to this treatment

were the ones in which there was some form of obstruction to the free flow of saliva, as they were able to demonstrate by lipiodol roentgenograms.

When an organ is active in the elimination of a drug, that drug, if it has an antiseptic action, is frequently found to be beneficial in combating an infection of the organ. The beneficial effect of antiseptics eliminated through the kidneys in urinary tract infections, is established. Iodine is promptly and rapidly eliminated by the parotid gland. With these facts in mind we administered Lugol's solution in acute secondary parotitis in large and continued doses until recovery. The dosage in the cases here reported varied, depending upon conditions and our experience in its administration. The drug is well tolerated and may be given in very large and repeated doses for days. In the more serious cases Lugol's solution was also administered by hypodermoclysis in saline.

Comment.—Three cases followed spinal anesthesia; two followed ether; two followed gas; one followed a local anesthetic. The fact that three cases followed spinal and one local anesthesia, tends to disprove the contention that pressure over Stenson's duct is responsible for this complication.

The ten cases treated with Lugol's solution were collected between 1929 and 1934, inclusive (Table I). In every case where a culture was made from Stenson's duct, either a *Staphylococcus aureus* or *albus* was recovered, except one which was a diplococcus. One case was bilateral; *Staphylococcus aureus* was recovered from the left Stenson's duct and a *Staphylococcus albus* from the right.

There were no signs or symptoms of iodism in any of the cases treated. In Case VII (Doctor Saltzstein's case), the parotitis began three days after a gastro-enterostomy. Lugol's solution, minims XX, was administered in this case every three hours without gastric upset.

Cases V and VIII require special comment. Case V was operated upon at the Evangelical Deaconess Hospital on July 26, 1932, by Doctor Koebel, for chronic pelvic inflammatory disease. The tubes were bound down and incorporated into a large chronic inflammatory mass. A bilateral salpingectomy and oophorectomy was performed. July 28 a fecal fistula developed. July 29 the patient complained of a painful swelling of the left parotid region, temperature 102°, pulse 120. The swelling increased; the pain was very severe. August 1, Lugol's solution, minims XV, was administered every three hours. Definite improvement followed. August 5 Lugol's solution was discontinued, after which the swelling again increased. August 10 an abscess broke into the auditory canal. August 12 Lugol's solution, minims XV, was again administered every three hours. August 13 an abscess was incised below the left ear. August 15 the patient was discharged, recovered. She was still suffering from the fecal fistula, however. Better results might have been obtained in this case if Lugol's solution had been given continuously in larger doses by hypodermoclysis.

Case VIII was operated upon at the Evangelical Deaconess Hospital October 22, 1933, for acute appendicitis. The appendix contained about one-half

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TABLE I

Acute Secondary Parotitis

Case	Patient	Operation	Age	Side	Lugol's	Duration	Onset	Organism	T. & P.	Anesthetic
I	Mrs. N. N.	Tooth extraction	42	R.	Minims XX q. 3 hours (total 320 minims)	8 days	2nd day	No culture obtained	101° Pulse 100	Local
II	Mrs. L. H.	Oophorectomy (hyaline ovary) and appendectomy (acute)	30	R.	Minims XX q. 3 hours (total 300 minims)	9 days	2nd day	*Staph. aureus*	102.6° Pulse 130	Ethylene gas
III	Mrs. I. R.	Right middle lobar pneumococcus Type II, pneumonia	48	R.	Minims XV q. 3 hours (total 90 minims)	3 days	9th day	No culture obtained	100.2° Pulse 100	
IV	Miss H. H.	Appendectomy (chronic)	18	R.	Minims XX q. 3 hours and minims LX by hypodermoclysis in saline on first and second day (total 255 minims)	7 days	3rd day	No culture obtained	103.6° Pulse 120	Spinal
V	Mrs. A. H.	Salpingectomy, double oophorectomy, separation of adhesions (chronic pelvic inflammatory disease), followed by fecal fistula	24	L.	Minims XX q. 3 hours (total 360 minims)	18 days	3rd day	*Staph. aureus*	101° Pulse 120	Nitrous gas
VI	Miss C. McD.	Simple left mastoidectomy (acute)	8	L.	Minims XX q. 3 hours (total 200 minims)	4 days	2nd day	No culture obtained	101.4° Pulse 130	Ether
VII	Mrs. M. T.	Gastro-enterostomy (pyloric ulcer)	53	L.	Minims XX q. 3 hours and minims LX by hypodermoclysis in saline on first and second day (total 500 minims)	10 days	3rd day	*Staph. aureus*	102° Pulse 120	Spinal
VIII	Mr. F. C.	Appendectomy (appendiceal abscess)	22	R. and L.	Minims XX q. 3 hours and minims LX by hypodermoclysis in saline for first six days (total 1480 minims)	15 days	2nd day	*Staph. albus* (rt.) *Staph. aureus* (left)	103° Pulse 110	Spinal
IX	Mrs. M. G.	Radical right breast amputation (malignancy)	42	L.	Minims XX q. 3 hours and minims LX by hypodermoclysis in saline on first and second day (total 360 minims)	5 days	2nd day	*Staph. albus*	101°	Ether
X	Mrs. E. R.	Pyonephrosis	75	L.	Minims XX q. 3 hours (total 640 minims)	5 days	21st day	Capsulated diplococcus gram-positive	102° Pulse 110	None

ounce of pus, not ruptured. The abdomen was closed without drainage after the appendix was removed. October 25 there was a painful swelling of the right parotid region, temperature 103°, pulse 110. October 27 the left parotid became involved. The white blood count was 26,000 with 89 per cent. polymorphonuclear leucocytes, 10 per cent. small lymphocytes, and 1 per cent. large lymphocytes. October 29 there was an enormous swelling of the entire face and neck; the right eye was completely closed. Lugol's solution, minims XX, was administered every three hours, day and night, until recovery. In addition, Lugol's solution, minims LX, was given daily in normal saline by hypodermoclysis for the first seven days. A thick purulent discharge could be expressed from each duct. Culture from the right parotid showed *Staphylococcus albus*; from the left, *Staphylococcus aureus*. November 3 fluctuation was noted below and posterior to the right ear. November 4 the abscess was aspirated with a large caliber needle. After five daily aspirations, recovery was prompt. The patient was discharged on the seventeenth post-operative day.

CONCLUSIONS

(1) Acute secondary parotitis has a mortality of over 35 per cent.

(2) Ten cases of acute secondary parotitis are reported which were treated with Lugol's solution, administered orally and by hypodermoclysis in saline.

(3) Two cases went to abscess formation.

(4) There were no deaths.

(5) These results justify the use of Lugol's solution in the treatment of acute secondary parotitis.

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THE TREATMENT OF SALIVARY FISTULA BY IRRADIATION

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Salivary fistulæ may be relieved by the temporary suppression of glandular secretory activity by irradiation. The method was first suggested seventeen years ago and since that time a number of reports on cases successfully treated have appeared, but so far as I can ascertain, none of these has appeared in the American literature. It is not within the province of this paper to discuss the many aspects of operative treatment for these troublesome conditions, but the basic principles which underly most operations and the reasons for the frequency of failure may be briefly mentioned.

Fistulæ of the submaxillary or sublingual glands do not often require any sort of treatment because they usually heal spontaneously. Some which have persisted have been cured by extirpation of the involved gland. The subject of the treatment of these fistulæ needs no other comment except to suggest that the experimental and clinical evidences which will be presented indicate that irradiation should be especially applicable to fistulæ from the submaxillary or sublingual glands. Spontaneous healing should be hastened or closure induced by suppression of secretion which should thus eliminate the necessity for removing the organ.

It is the parotid fistulæ which are particularly obstinate and but few of them close spontaneously. The difficulties which attend the surgical cure of parotid salivary fistulæ are manifest by the fact that as many as thirty different operations have been devised for only those fistulæ which originate from that part of the gland which lies over the masseter muscle.

Two types of fistulæ are encountered: the first caused by opening of Stenson's duct; and the second, sinus tracts originating in the glandular structure. They are usually due to accidental lacerations or surgical incisions and occasionally to inflammation about salivary calculi which leads to necrosis of tissue and sinus formation.

Simply suturing a wound of the parotid will not prevent the formation of a fistula nor close one that is established. If Stenson's duct has been severed, a plastic operation upon it may or may not cure the condition. If only the gland tissue has been cut, the sutures sometimes act as foreign bodies and actually cause the formation of fistulæ, especially if the wound is infected, which is usually the case since contamination easily takes place from the buccal mucosa or from an external source.

Some of the operative technics which have been suggested for fistulæ depend upon isolating the cut ends of Stenson's duct and anastomosing them with or without some material inserted into the lumen of the duct, as a dowel,

to keep it patent until healing occurs. By another method the proximal end is drawn into the buccal mucosa and implanted to make a new excretory orifice. The entire gland or portions of it have also been extirpated. Still another treatment depends upon severing or evulsion of the auriculo-temporal nerve to eliminate the neuromechanism of glandular secretory activity.

The difficulties of curing salivary fistulæ by these operations, the objections to them, and the causes for failure are as follows: (1) The amount of saliva which is secreted in a twenty-four hour period is equal to that of the urine or about 2,000 cc. Therefore one gland secretes about 500 cc. This fact suggests that it must be difficult indeed to perform an operation, which is manifestly technically delicate, in order to stem the tide of such a continuous and copious flow. (2) When infections take place after operation, the fistula will almost surely be reëstablished and contamination is almost the rule rather than the exception. (3) As a result of the operative manipulation, the lower branch of the facial nerve may be damaged with resulting paralysis of the muscles at the angle of the mouth which causes facial deformity. (4) The operations upon the auriculo-temporal nerve do not always promptly eliminate the secretory activity of the gland which may continue for considerable periods of time because fibers from the great auricular nerve and the sympathetics from the carotid plexus maintain function. (5) Removal of the whole parotid is practically impossible without serious damage, especially to the facial nerve. When only a portion of it is removed, and only that part in the neck can be successfully extirpated, the rest of the gland suffers injury of greater or less severity.

The first report on the treatment of a case of salivary fistula by roentgen irradiation was that by M. Fraenkel[4] in 1916. This patient had had a war injury of the ear and parotid gland and the infected wound and the salivary fistula were promptly healed after irradiation. Fraenkel[5] later (1923) discussed the influence of irradiation upon excessive salivation in chronic lethargic encephalitis and L. Biermer[1] also found that the salivation of pregnancy could be controlled. In a paper on the treatment of parotid fistulæ by the injection of alcohol into the trigeminus, Stropeni[18] (1920) also mentioned that the activity of the gland might be suppressed by irradiation. Those who have reported on cases of fistulæ successfully treated by roentgen therapy include F. W. Kaess[10] (1923) with two cases; K. Kleinschmidt[11] (1923) who mentioned six cases; H. Schädel[17] (1923) who cited another case (gunshot wound) in discussing Kaess's article; H. Henke[6] (1924) described three cases of parotid fistulæ resulting from operations upon the ear that were benefited by roentgen therapy. W. Kremer[13] (1925) had success with one case. J. Kopary[12] (1926) wrote about five cases, one of which is especially interesting because the fistula had existed for eighteen years prior to treatment. C. Wittkowsky[20] reviewed the literature up to 1928 and added two of his own cases; and the method has been mentioned by H. Holfelder[7] (1922), H. Rahm[15] (1927) and a few others. According to the case reports cited, roentgen irradiation has successfully relieved all of the patients, in some instances after repeated failures of operations.

No doubt the idea of applying roentgen irradiation for salivary fistulæ was suggested by the frequent clinical observation that patients being treated over the gland areas for other conditions subsequently almost invariably complained of dryness of the mouth. This was obviously due to suppression

of the salivary secretions and was particularly manifest after the advent of high voltage therapy. This has been commented upon in the literature by many observers.

Experimental studies on this effect of irradiation upon the salivary glandular activity were made in order to interpret this clinical observation by Ivy, Orndoff, Jacoby and Whitlow[9] (1923), H. von Salis[16] (1924) and Boldyreff[2] (1925). The effect of irradiation was also noted by I. Horowitz[8] (1911), W. S. Lazarus-Barlow[14] (1922) and M. Tsuzuki[19] (1926) as coincidental findings in certain experiments which were not directed particularly to observations on the salivary glands. A. U. Desjardins[3] (1931) made a review of reports in the literature on the experimental aspects of the effect of irradiation upon the gastro-intestinal tract and from these reports summarized the effects on the salivary glands as follows:

> There is no valid evidence that small doses of radiation increase the functional activity of the salivary glands; on the contrary, the evidence indicates that small doses have no effect, but that strong doses interfere with their function and diminish the secretion of saliva causing metabolic inhibition and degeneration of the specific epithelium of the glands. The degree of such action, as well as its onset and duration, depends on the dosage and the effect of irradiation may be temporary or permanent for the same reason. . . . The salivary glands are exceptionally sensitive to irradiation. . . . The late reaction consists in dryness of the mouth which appears from a few days to two or three weeks after irradiation of most or all of the salivary glands, is most pronounced two to four weeks after exposure, subsides slowly thereafter, and is due to decreased secretion of saliva.

The microscopic changes which have been described in the tissues of the salivary glands following experimental irradiation are the usual evidences of degeneration which begin very promptly. The degree of the reaction and manifestations depends upon the length of time intervening since the application and is proportionate to the intensity applied. Apparently the mucus-secreting cells are the most radiosensitive but the serous cells and the epithelial cells lining the interlobular ducts are also affected by sufficient dosage. Within a few hours there is hyperemia of the whole gland structure. This is clinically manifest by swelling, increased local temperature and some discomfort which subside within forty-eight hours. Infiltration of lymphocytes then takes place about the ducts, blood vessels and in the stroma; then the alveolar cells and those lining the smaller ducts begin to degenerate. The cells swell and become edematous, and the nuclei shrink and disintegrate. Eventually these reactions cause a great increase in the fibrous-tissue stroma of the gland. The lumen of the interlobular ducts, the lining cells of which undergo degenerative changes, become clogged with débris. The large tributary and the main salivary ducts do not undergo such marked degenerative changes but are hyperemic and surrounded by round-cell infiltration. As a result of such extensive degeneration in the gland, its function is diminished in proportion to the amount of alveolar tissue affected.

A number of years ago we had observed the phenomenon of salivary suppression after intensive roentgen treatment of the regions occupied by

the salivary glands. Our patients had complained of the primary reaction of swelling and ultimately of dry mouth, but in our experience this discomfort was transitory, or at least the patient no longer mentioned it and the function returned in from three to four months. On the basis of these experiences and from the experimental evidences reported, we had anticipated applying roentgen irradiation for the treatment of salivary fistulæ whenever such patients should appear. We expected that the secretory activity of the glands might be suppressed for a sufficient period of time for the fistula to close before the gland would resume more or less normal function. Three patients have been treated recently and their histories illustrate the results of irradiation therapy.

Case I.—A young woman entered the Cleveland Clinic with the signs and symptoms of exophthalmic goiter which were relieved by the removal of a hyperplastic thyroid gland by Doctor Crile. In her history she stated that six years previously she had suffered a fracture of the skull in an automobile accident. She had had an operation behind the ear (craniotomy) for a blood clot and during her convalescence had had parotitis which necessitated incision of the gland. Since that time she had had a constant seepage of clear fluid from a pin-point sinus in the operative scar behind and below her ear. The drainage had ceased occasionally for a week or two but always recurred and continued for two or three months. The ingestion of food and at times the smell of food increased the flow temporarily. During convalescence after the thyroidectomy, roentgen irradiation was administered over the parotid region. The drainage ceased in one week and has not recurred for two years.

Case II.—The patient, a man, had been cut deeply through the parotid by flying glass in an automobile accident. Stenson's duct and the middle branch of the facial nerve had been severed, with resultant paralysis and salivary fistula. An unsuccessful attempt had been made to repair the fistula. When seen, the parotid gland was swollen, hot and tender from infection and in the center of the sutured wound a salivary fistula had been draining constantly for more than a month. Roentgen treatment was administered on two succeeding days after which the inflammation in the gland subsided and since the fourth day there has been no drainage from the fistula for one and a half years.

Case III.—The patient was a man in whom a basal cell epithelioma had been present over the parotid region and had been successfully treated by radium three years previous to this examination. An ulceration—a reaction to the treatment—had left a parotid fistula which had been draining since that time. Roentgen therapy was administered, and although, as the result of the radium treatment, there was a considerable amount of fibrosis about the fistulous opening which prevented complete closure, the salivary drainage has been controlled for periods of from four to six months by occasional treatments during the past one and one-half years.

Technic.—The experimental evidence indicates that small doses of less than 40 per cent. of an erythema skin dose of irradiation have little or no influence upon the secretory activity of the salivary glands, and so high voltage (180 or more kilovolts) and heavy filtration (not less than 0.5 mm. copper) should be employed. Each of the three patients reported here received 800 roentgens as measured on the skin over the parotid gland in applications of 400 roentgens on each of two succeeding days. The method of applying the irradiation is not important if the dosage is large enough. It may be that patients who have not responded satisfactorily to roentgen therapy have not had sufficient dosage of hard radiation. Undoubtedly

radium packs which cover the whole parotid gland should be as efficacious as roentgen irradiation but would be somewhat more difficult and less convenient to apply in many cases.

Observations made from clinical experience in the treatment of other conditions and of cases of salivary fistula and the reports in the literature indicate that the primary reaction following irradiation is a temporary (twenty-four hours) swelling of the salivary gland with moderate pain which may be relieved by hot applications. A slight erythema reaction should appear in about three weeks and subside in another month. Epilation over the area treated ensues in about a month, is not objectionable and hair will begin to return in about four months.

Conclusion.—The secretory activity of the salivary glands may be suppressed by irradiation, and therefore, may bring about a cessation of drainage in cases of parotid fistula. The function of the gland may be resumed in about four months, but in the meantime the fistula usually closes. If seepage recurs, the fistulous tract might be mildly cauterized and the gland again irradiated. Also irradiation might be employed to suppress the salivary secretion temporarily before a plastic operation is performed in particularly obstinate cases. Although it is possible to destroy the function of the gland permanently by irradiation, if necessary, in some cases temporary suppression will suffice to effect closing of the fistula.

On account of the difficulties encountered in the surgical treatment of salivary fistulæ and because the irradiation is so easily applied and so successful, it would seem advisable always to employ the latter method first and to reserve operative procedures for the cases which possibly, but improbably, might not respond to irradiation therapy.

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HYPERTHYROIDISM IN THE AGED

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During the four years, 1930 to 1933 inclusive, 145 patients of sixty years or over were operated upon in the Lahey Clinic for hyperthyroidism. This represents approximately 7 per cent. of the toxic patients operated upon in the clinic during that interval. While it is well known that hyperthyroidism may occur in elderly people, it is perhaps not appreciated how frequently this disease is present in patients of advanced years. We wish to review the salient features of hyperthyroidism as it occurs in aged people, to note such variations as occur because of their increased years, and to discuss the methods and results of treatment in these patients (Fig. 1).

Fig. 1.—Mrs. C. C. (No. 20,874). Age sixty-four. Adenomatous goitre with hyperthyroidism (activated type). Metabolism + 50. Weight 108 pounds. One-stage thyroidectomy March, 1931. In May, 1932, metabolism − 10. Weight 145 pounds.

During the four years we are discussing, 1,584 patients with exophthalmic goitre were operated upon in the clinic and seventy of these patients, or 4.4 per cent., were sixty years or more of age. In the same interval 373 cases of adenomatous goitre with hyperthyroidism were operated upon and seventy-five, or 20 per cent., of these patients were sixty years or more of age (Table I). It is evident from these figures that while in these four years we saw four times as many patients with primary hyperthyroidism as we saw with secondary hyperthyroidism that the secondary hyperthyroidism was seen nearly five times as frequently in aged people.

It is generally appreciated that primary hyperthyroidism or exophthalmic goitre is a disease of youth or middle age and so the fact that only 4 per cent. of these elderly patients had exophthalmic goitre is in keeping with this established experience. It is equally well known that adenomatous goitre with secondary hyperthyroidism is a disease of late middle life since secondary

hyperthyroidism generally does not arise until the patient has had a goitre a number of years. It is also true that primary hyperthyroidism is less frequently diagnosed in elderly people than adenomatous goitre since the goitre in primary hyperthyroidism is much less noticeable and the disease is not

TABLE I

Incidence 1930 - 1934.

of 1584 cases Ex. G. 70 aged 60+ yrs. = 4.4%
of 373 cases Tox. Ad. G. 75 aged 60+ yrs. = 20.0%
total 1957 Toxic cases – 145 aged 60 yrs. = 7%

commonly suspected in the aged. This may account for some of the relative infrequency of reports of this disease in old people (Fig. 2).

The symtomatology of hyperthyroidism in elderly people is often the same as in young and middle aged patients. In the typical patient with exophthal-

FIG. 2.—Mrs. S. C. (No. 392,281), age seventy-three, weight loss 36 pounds in five months. B.M.R. + 72, April 4, 1934. Two-stage thyroidectomy. Exophthalmic goitre. Excellent recovery. B.M.R. + 4, June 14, 1934. Twenty pounds' gain in weight.

mic goitre the diagnosis can be made quite readily since all the classical symptoms will be present. In other patients, however, of the apathetic type which has been described by Doctor Lahey, the presence of hyperthyroidism is often not readily discerned and in many instances may for a long time be unrecognized.

We have reviewed the leading symptoms in each of the 145 patients in this study. We have found that the four outstanding symptoms in these elderly people, who were proven to have hyperthyroidism, were weight loss, palpitation of the heart, increased nervousness and myaesthenia. Next in frequency of leading complaints in this group of patients were dyspnea, sense of pressure in the neck and front of the chest, increased sensation of warmth, trembling of the legs, muscles and hands, edema of the feet and irregular heart action.

Weight loss coming on in an elderly person is always a significant symptom. In sixty-nine of the 145 patients in this group this was the chief complaint. In more than half of all these elderly patients weight loss was accompanied by a definitely increased appetite. In over 40 per cent. of the patients, however, there was no increased appetite, and it is to be noted that in these patients the amount of weight loss was often pronounced. The average weight loss in sixty-five patients with primary hyperthyroidism was thirty-two pounds, and the average weight loss in seventy-two patients with

TABLE II

Weight loss chief complaint - 48% cases
Ex. G. - Average loss 32 lbs.
In 15 cases loss of 50 to 90 lbs. in each.
Toxic Ad. G. Average loss 21 lbs.
In 7 cases loss of 50 to 60 lbs. in each.

adenomatous goitre was twenty-one pounds. In the toxic adenomatous goitre cases the largest weight loss noted was sixty pounds, and in seven of these patients the weight loss ranged between fifty and sixty pounds. In the exophthalmic goitre patients, however, one individual had lost ninety pounds, and in fifteen cases the weight loss ranged between fifty and ninety pounds (Table II). It is at once apparent from the above figures that weight loss and emaciation of serious degree are present in more than half of the cases of hyperthyroidism in elderly patients and are not only of great clinical importance but also of diagnostic significance.

Second in frequency in this group of elderly patients were symptoms pointing to increased stimulation or definite damage to the cardio-vascular system. Thus, in sixty-seven, or approximately half of the cases, palpitation was given as the leading symptom. Shortness of breath was complained of in twenty-two cases, and increased ease of fatigue in fifty-three patients. Only six of the patients complained of irregular heart action and only two of anginal attacks.

On examination, however, fifteen of the exophthalmic goitre cases and twenty-five of the adenomatous goitre cases showed auricular fibrillation on admission, and nine of the patients with exophthalmic goitre and eleven of those with adenomatous goitre showed evidences of heart failure on admission (Table III). In other words, sixty of these 145 patients showed definite

evidence of cardiac damage either as auricular fibrillation or as congestive heart failure on admission to the hospital. This high incidence of cardiac complication is not surprising in patients who are sixty or more years of age since it is in old hearts damaged by sclerotic changes or previous cardiovascular disease that the drive of hyperthyroidism most commonly produces evidence of heart failure.

TABLE III

Cardiac Involvement of 145 cases

Auricular Fibrill.	– 40 cases	– 15 Ex. G.	– 25 T. Ad. G.
Cardiac Failure	– 20 cases	– 9 Ex. G	– 11 T. Ad. G.
total	60 cases		

Eye signs were quite common in these elderly patients in the exophthalmic goitre group but were relatively rare in the patients with toxic adenomatous goitre. Thus, 40 per cent. of the exophthalmic goitre patients showed exophthalmos which was uniformly absent in the toxic adenomatous goitre cases. Sixty per cent. of the exophthalmic goitre patients showed stare, while only 11 per cent. of the adenomatous goitres had this finding. In only one patient in the group was any disturbance in vision noted, and this was seen in a woman of seventy-two with unilateral exophthalmos.

Activation was present in more than half of all these toxic patients, and well marked, fine tremor of the extended fingers was also noted with great regularity. A hot, moist skin was a most helpful diagnostic sign in these

TABLE IV

Basal Rates

	Ex. G.	T. Ad. G.
+20 or less	17%	12%
+20 to +40	44%	62%
Over +40	39%	26%

elderly patients as in their younger prototypes and was present in more than three-quarters of all the patients.

The basal metabolic rate in hyperthyroidism of the aged varies in most instances with the obvious intensity of the intoxication just as it does in younger people. There is, however, a proportionately larger group of aged patients with basal rates only slightly elevated who are very ill with hyperthyroidism than there is in the younger age group. These generally are patients of the apathetic type.

In the primary hyperthyroidism patients or exophthalmic goitre group, basal rates of +40 or over occurred in 39 per cent. Medium rates between +20 and +40 occurred in 44 per cent. and low rates below +20 occurred in 17 per cent. In the toxic adenomatous goitres, or secondary hyperthyroidism

group, basal rates which were +40 and over occurred in only 26 per cent. of the cases, while in 62 per cent. of the cases the rate varied from +20 to +40 in the medium field. In 12 per cent. of the patients the rate was +20 or less (Table IV).

There is no patient with hyperthyroidism in whom the basal rate may be more misleading than in the aged. It is not uncommon in patients over sixty to have every clinical evidence of a most severe, long-standing thyroid intoxication with elevated pulse rate, marked weight loss, and tremendous weakness and yet a low basal metabolic rate of +25 or +30. These are the dangerous cases, and it is to be emphasized that the relatively low basal rates in these patients are in no way indices to the severity of their intoxication or guides to the amount of surgery which can be performed safely.

We were able to learn relatively little from the blood pressure estimations taken at the time of the basal metabolism tests in these patients. Dr. Lewis M. Hurxthal[1] in this clinic has reported fully on the blood pressure before and after operation in hyperthyroidism. In this study he showed that the average basal blood pressure reading following relief from hyperthyroidism in exophthalmic goitre and from toxic adenomatous goitre is approximately the same in each age group up to fifty years, but thereafter it is slightly higher in the toxic adenomatous group.

In our patients the average basal pulse pressure in the exophthalmic goitre group was 90.5 mm. of mercury and in the toxic adenomatous goitre patients it was 81.2. The average basal blood pressure in these elderly patients having exophthalmic goitre was 162/71, and the average basal blood pressure in the toxic adenomatous goitre patients was 160/79. In comparison we may note that in Doctor Hurxthal's study he found that the average basal blood pressure in nontoxic goitres between the ages of sixty and sixty-nine was 142/80. In twenty-five patients with exophthalmic goitre in his study the average basal pressure was 164/70, and in fourteen patients with toxic adenomatous goitre, Doctor Hurxthal found that the average basal pressure was 161/87.

There were in this group of 145 elderly patients individual instances in which the blood pressure was elevated over 200 and in which marked evidences of hypertension and hypertensive heart disease were present. None of these patients, however, succumbed to operation and it has not been our experience that such elevations of blood pressure interfere with the successful completion of thyroidectomy in the elderly patients.

Tachycardia was a constant finding in all the group. Only thirty patients in the entire 145 have a basal pulse rate below ninety. In some of these the lower pulse rate was definitely a digitalis effect. Constant tachycardia in the elderly patients stands out as one of the constant findings in their examination, and it is a finding which in our experience is always very significant and suggestive. In over ninety of these patients the basal pulse

rate was 100 or over, and in many instances was 130 to 150 during the basal metabolism test.

The preferred treatment of hyperthyroidism in our experience is the same for the elderly patients as for the youthful individuals. Thus, we have found that subtotal thyroidectomy can be safely carried out in these elderly patients; that the immediate mortality is low, and that the postoperative results are gratifying (Fig. 3).

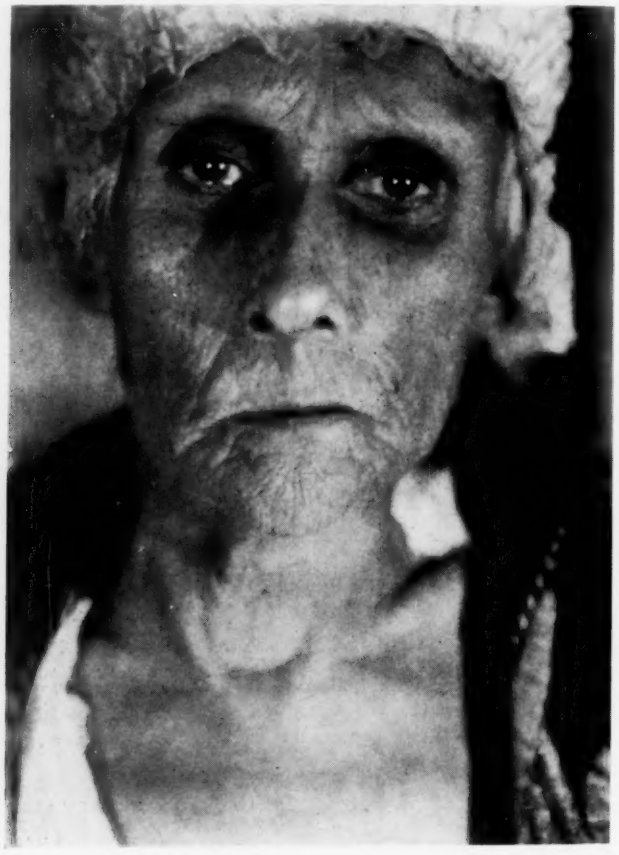

FIG. 3.—Mrs. H. L. (No. 1548). Age seventy-one. Adenomatous goitre with hyperthyroidism (apathetic type). Metabolism + 51. Weight 108 pounds. Two-stage thyroidectomy in 1927. Metabolism — 1. Weight 150 pounds in 1929. Died pneumonia, 1933.

We have always maintained that multiple-stage operations were essential in maintaining a low mortality in the surgery of hyperthyroidism. It has been our contention for many years that in the presence of long standing toxicity, marked weight loss, and advanced years of the patient that divided operations were necessary to maintain a low mortality rate. In these patients of sixty or more years of age, divided operations were done in more than half of the cases (56 per cent.), and subtotal thyroidectomy in one stage was performed in only 44 per cent. of these people (Table V). The figures

vary somewhat for the patients with primary hyperthyroidism in which sixty-seven per cent. were done in divided operations and 33 per cent. in one operation. In adenomatous goitre with toxicity, 55 per cent. were done in one stage and 45 per cent. were done in two stages.

The mortality for this group of 145 cases should be considered in the light of the operation performed and particularly, I believe, in the light

TABLE V

Operations in	group	Ex. G.	T. Ad. G.
One Stage	44%	33%	55%
Two Stages		60%	44%
Three Stages		7%	1%

of the number of stages of operation which were carried out. Thus, we find that in the seventy patients with exophthalmic goitre, there were no fatalities, and we note that over two-thirds of these patients were done in multiple-stage operations (Table VI). In the toxic adenomatous goitre patients, however, there were three fatalities, and we must at once face the fact that 55 per cent. of these patients were operated upon by subtotal thyroidectomy in one stage. Although we recognize that pole ligation and hemithyroidectomy are oftentimes undesirable technical procedures in adenomatous goitre, yet I believe we must emphasize that in the toxic adenomatous goitres, more than

TABLE VI

Operative Mortality

		Ex. G	T. Ad. G.
All Toxic Cases 1930–1934		0.6%	1.8%
145 aged patients	3 deaths 2% —	0%	4. %

half were done in one stage, and all the mortality occurred in this type of goitre.

The three deaths that occurred in these elderly patients may be briefly reviewed. The first was the result of a sudden post-operative hemorrhage which produced tracheal pressure and asphyxiation. Incidentally it may be said that this is the only death from hemorrhage which to our knowledge has occurred in over 12,000 goitre operations in the clinic. The second death occurred in a woman of sixty-six with severe hyperthyroidism and advanced diabetes. Her death came from multiple emboli ten days following a second stage hemithyroidectomy. The third death was apparently a crisis of hyperthyroidism coming within twenty-four hours after the removal of one side of a toxic, adenomatous goitre.

As we review these three fatalities we may say that certainly two of them were in no way related to our judgment, the first being the result of a technical difficulty, and the second being due to multiple emboli coming from

a fibrillating heart ten days after a successful thyroidectomy. In the third patient it may be that any operation at all was contraindicated, or it may be that pole ligation should have been done instead of the removal of the single large discrete adenoma which he had. The patient entered the hospital with marked congestive heart failure and obviously severe secondary hyperthyroidism. After some three weeks preparation, however, it was felt that we could successfully remove half of his thyroid. Death in this case could have been avoided by refusing this man operation or possibly by ligating his superior vessel as a preliminary step.

The total mortality for this group of aged patients sixty years and over was three deaths in 145 cases or 2.06 per cent.

FIG. 4.—Mrs. L. H. (No. 36,139). Age seventy-seven. Referred by Dr. Elliott Joslin. Severe diabetes and toxic adenomatous goitre. In October, 1933, metabolism + 46. Weight 106 pounds. Two-stage thyroidectomy. In March, 1934, metabolism + 13. Weight 112 pounds. Diabetes now readily controlled.

The results following thyroidectomy for hyperthyroidism in aged patients are most satisfactory, in fact they are at times even more striking than the results seen after thyroidectomy in younger patients. The apathetic patient regains her weight, loses her apathy, acquires a new facial appearance, and a fresh interest in her surroundings; notes the return of muscular strength and appetite, and within a few weeks is up and about and in excellent health. The patients with disabling heart symptoms are relieved in a strikingly short period after thyroidectomy. Patients having congestive heart failure are permanently relieved of their failure by the removal of their thyroid intoxication. Patients with diabetes, of whom there were several in this group, obtain an increased tolerance for carbohydrates and diminished need for insulin following the removal of their hyperthyroidism (Fig. 4).

Hyperthyroidism occurs in aged people over sixty years of age in both a typical and an atypical manner. In the typical cases, it can be recognized by the activation, tachycardia, tremor, increased appetite and weight loss. In the atypical or apathetic type of case, the hyperthyroidism may be veiled by the absence of the so-called typical symptoms of thyroid intoxication. In both types of case, thyroidectomy, often in divided operations, can be safely performed with a very low mortality, and the results of this operation in these aged people are fully as striking as in the youthful group of individuals who suffer from thyroid intoxication.

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MALIGNANT NEOPLASM OF THE THYROID*

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Between the years 1923 and 1933, 1,096 cases of diseases of the thyroid gland were under observation in the Jefferson Hospital. In this series we have observed 24 cases of malignant disease, representing 2.18 per cent. In comparison with other clinics we find that Wilson[1] in 1921 from the Mayo Clinic gave 1.7 per cent, Speese and Brown[2] in 1921 gave 4.6 per cent.

When we consider the age incidence, we find the greatest number of cases in the seventh decade. There were nine cases in the seventh decade, seven in the fifth, three in the fourth, two in the sixth, two in the eighth and one in the ninth.

Sex is interesting in that of 1,096 cases of goiter, 839 were in females and only 257 were in males. This gives a percentage of 3.22 females to one 54.2 per cent of the malignant cases. In 257 cases of goiter in the male, 11 were malignant, representing 45.8 per cent of the malignant cases. From this we have found that males with goiter are more liable to develop malignancy than the females. By comparison, we find that Muller and Speese,[3] in 1906, gave 60 per cent in females and 40 per cent in males; while Schreiner and Murphy,[4] in 1934, gave 69 per cent in females and 31 per cent in males. Levinson[5] gave 51.4 per cent in females and 48.6 per cent in males. This is a lower percentage for females than in our findings. It is noteworthy that there was not a colored patient in this series of malignant goiters. The predominant race was Italian (Table 1).

Pathology.—Malignant tumors of the thyroid gland develop from the epithelial or from the connective tissue structure. When they develop from the epithelial structure they are classified as carcinoma. They are classed as sarcoma when they develop from the connective tissue structure. In this series we are in accord with the general belief that sarcoma is less common than carcinoma. Extension from the larynx or the esophagus must be excluded as a possible initial site for these tumors. From this series of 24 cases of neoplastic disease of the thyroid gland three types of malignancy are reported. They are adenocarcinoma, sarcoma and a rare type of epithelial tumor called epidermoid or squamous cell carcinoma. The diagnosis in 15 of the 24 cases was confirmed by histologic sections taken either by operative means or at necropsy. In the other nine cases the diagnosis was obvious, due to the advanced stage of the disease, and the roentgen ray findings of metastases. Of

* Read before the Philadelphia Academy of Surgery, May 7, 1934.

TABLE I

Summary of Malignant Thyroids at Jefferson Hospital, 1923–1933

No.	Sex	Age	Roentgen Ray and Clinical Diagnosis	Histologic Diagnosis	Metastases	Treatment	Results
1	Female	39		Low grade adenocarcinoma	0	Surgical removal	Well 1½ yrs.
2	Female	68		Mixed cell sarcoma	0	Biopsy	Died 2 wks.
3	Female	67	+		Lungs		Died 2 mos.
4	Female	63		Anaplastic adenocarcinoma	Lungs and kidneys (necropsy)		Died 1 mo.
5	Female	48		Low grade adenocarcinoma	0	Biopsy	Not traced
6	Male	49		Anaplastic adenocarcinoma	Lumbar spine	Surgical removal	Died 2 mo.
7	Female	63	+		Lungs and mediastinum		Not traced
8	Female	38	+	Anaplastic adenocarcinoma	Lungs and l. femur	Roentgen ray	Died 2 mos.
9	Female	73	+		0	Roentgen ray	Not traced
10	Male	58		Mixed cell sarcoma	0	Biopsy	Died 2 mos.
11	Male	38		Low grade adenocarcinoma	0	Surgical removal	Died 4 yrs.
12	Male	55	+		0		Died 2 mos.
13	Female	69	+		0	Roentgen ray	Died 6 yrs.
14	Male	69	+		0		Died 1 wk.
15	Male	67			0	Radium	Died 1 yr.
16	Male	82		Epidermoid carcinoma	Lungs	Radium	Died 7 mos.
17	Female	61	+		0	Radiation	Died 7 mos.
18	Female	61		Low grade adenocarcinoma	0	Surgical removal	Well 8 yrs.
19	Female	73	+		0	Radiation	Not traced
20	Male	42		Anaplastic adenocarcinoma	0	Surgical removal	Not traced
21	Male	48		Intermediate adenocarcinoma	Lungs, liver and stomach	Necropsy	Died 1 mo.
22	Male	69		Intermediate adenocarcinoma	0	Biopsy	Not traced
23	Female	45		Intermediate adenocarcinoma	0	Surgical removal	Well 3 yrs.
24	Female	48		Intermediate adenocarcinoma	0	Biopsy	Not traced

the 15 cases in which sections were made, 12 of them were reported as adenocarcinoma; two as mixed cell sarcoma, and one as epidermoid or squamous cell carcinoma; of the 12 cases reported as adenocarcinoma, four were classed as low grade type of malignancy (Fig. 1). Four were classed as intermediate type (Fig. 2), which is somewhat more malignant than the first type. The remaining four were classed as anaplastic (Fig. 3) which forms the most malignant type.

Sarcoma of the thyroid is uncommon and some authors even deny its existence. We had two cases that showed this type of malignancy (Fig. 4). One of them occurred in a woman 68 years of age and the other in a man of 58. The epidermoid type of carcinoma (Fig. 5) occurred in a man of 82.

The possibility of this having been primarily in the larynx or esophagus was ruled out by bronchoscopic examination.

It is interesting to note the frequency of metastases in the anaplastic type of adenocarcinoma, metastases having occurred in three of the four cases. On the other hand, the other two types of adenocarcinoma were relatively free from metastases. Metastases occurred in only one of the four cases of the intermediate type and did not occur in any of the four cases classed as low

FIG. 1.—High power section showing low grade type adenocarcinoma of thyroid gland.

grade type of malignancy. There was no metastasis in the two cases of sarcoma. The epidermoid carcinoma showed metastases to the lungs. The most common site of metastasis was lung.

Prognosis, Treatment and Results.—The prognosis depends upon the period of the disease in which the patients present themselves for treatment. This is emphasized by the fact that 18 of the 24 cases of thyroid malignancy were inoperable on admission. Of the 18 inoperable cases nine died within six months, three within one year and only one lived more than one year. Five of these inoperable cases could not be traced, but in view of the roentgen

ray findings of metastases we are sure they died of the disease. One of the cases was very interesting in that while at the hospital he showed all the symp-

FIG. 2.—Low power section showing intermediate type adenocarcinoma. (From Case XXI.)

FIG. 3.—Low power section showing anaplastic type adenocarcinoma. (From Case VI.)

toms of bleeding gastric ulcer or carcinoma of the stomach. There were no clinical findings suggestive of carcinoma of the thyroid gland. At necropsy

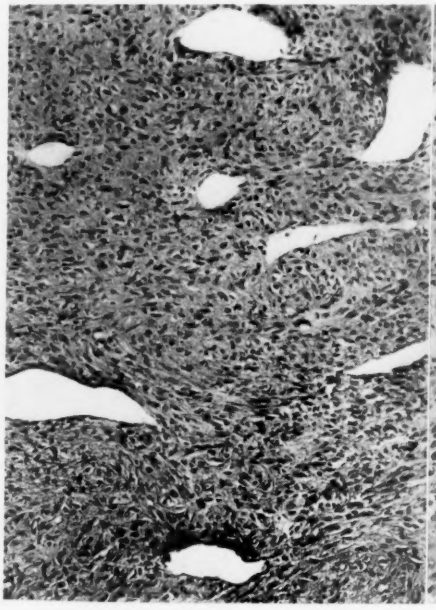

FIG. 4.—Section from Case II, showing mixed cell sarcoma.

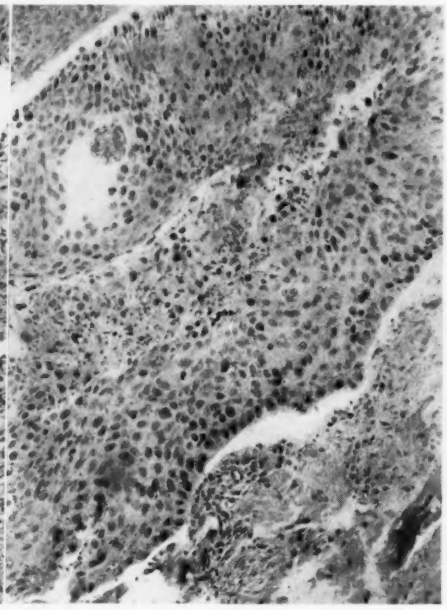

FIG. 5.—Section showing the epidermoid or squamous cell type of carcinoma.

the gross and histologic sections of the thyroid gland showed neoplastic changes with metastases to the stomach, lungs, and liver.

We have found that most of the cases that get well of malignancy of the

thyroid gland are those that are not diagnosed clinically, but are diagnosed from the histologic study of the gland removed for adenoma. This is illustrated in two of our cases, one of whom lived for four years after operation and the other is still well after eight years. Only six of the 24 cases received surgical treatment. Two of the six could not be traced.

Of the few cases which were operated upon and traced, one is well one and one-half years; one three years; and the other two four and eight years after operation, respectively.

CONCLUSIONS

(1) With few exceptions, metastases occur relatively late in thyroid malignancy; consequently, protracted medical treatment of adenoma of the thyroid gland should not be condoned because of the occurrence of malignant degeneration in this type of case.

(2) Even if the existence of sarcoma of the thyroid gland is questioned by some authorities, we believe that it still holds its place as a pathologic entity.

(3) When the roentgen ray shows metastases in thyroid malignancy, the case is beyond the scope of surgical treatment.

(4) When the disease is limited to the thyroid gland and adjacent lymphatics, surgical treatment should be instituted.

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END-RESULTS OF THYROID SURGERY*

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The end-results of thyroid surgery have been so clearly and ably presented from many clinics that there can be no doubt as to the efficacy of the surgical treatment of thyrotoxicosis. No writer has denied that there is occasionally a recurrence of toxicity, yet the vast majority of patients are restored to complete health and economic efficiency, and indeed many of them furnish the most dramatic results seen in surgery today.

Unless there is an adequate follow-up system and the records are scrupulously and conscientiously analyzed, one can never know what percentage of patients have recurrences. Such a study of 100 consecutive cases in our clinic in 1927[1] showed the incidence of recurrent thyrotoxicosis to be 5 per cent in cases of diffuse toxic goiter. Since it is desirable to know the results being obtained from time to time, the cases operated upon during the five-year period (1927–1932) have been reviewed. During this period there were 1,216 thyroid operations done upon 965 patients. Thus 26 per cent of all cases were operated on in two stages. The series was divided as follows:

Table I

Diffuse toxic goiter	578	60%
Nodular toxic goiter	202	20%
Nodular nontoxic goiter	145	15%
Diffuse nontoxic goiter	22	2%
Carcinoma	7	1%
Thyroglossal cyst	7	1%
Sarcoma	1	—
Ligneous thyroiditis	2	—
Acute suppurative thyroiditis	1	—
	965	

It will be noted that the percentage of diffuse toxic goiter is much higher than in those parts of the country where endemic goiter is prevalent.

The average age for the various groups is shown in Table II.

Table II

Diffuse toxic goiter	34
Diffuse nontoxic goiter	36
Nodular nontoxic goiter	39
Nodular toxic goiter	42
Carcinoma	51

* Read before the Philadelphia Academy of Surgery, May 7, 1934.

Advantage was taken of the opportunity to observe the value of iodine in the preoperative preparation of diffuse toxic goiters; compared with its effectiveness in nodular toxic goiters. All the cases admitted to the hospital with a basal metabolic rate of plus 35 per cent, or above, were utilized for this aspect of the study. The results are shown in Table III.

TABLE III

	Diffuse Toxic Goiter	Nodular Toxic Goiter
First B. M. R.	+60%	+55%
Preoperative B. M. R.	+32%	+30%
Days of preoperative treatment	11	10

These results show that the two types of goiters respond similarly to preoperative treatment consisting of iodine, sedatives, and rest, and confirm our earlier observations[1] with which Plummer did not agree.

Our system of follow-up consists of an examination four, 12, and 24 months after operation. A basal metabolic rate is taken routinely before the patient is examined by the physician. In this series there were 578 patients operated upon for diffuse toxic goiter. A few of these have been followed for less than one year, a number for from one to two years and 45 per cent for two years or more. Nineteen per cent would not or could not return for examination and so are not considered in our study. Our patients have been classified in six groups according to results. This is seen in Table IV.

TABLE IV

End-results in Diffuse Toxic Goiters

F. U.	No.	Well	Resid. Sympt.	Resid. Visc. Changes	Hypo-Thyroid	Resid. Tox.	Recur. Tox.
2–5 yrs.	269	199	26	9	1	22	12
1–2 yrs.	145	114	17	2	1	7	4
4–12 mos.	53	50	1	0	0	2	0
Total	467	363	44	11	2	31	16

Group 1 includes patients who are entirely well. Group 2 consists of patients who have normal basal metabolic rates and who are certainly not thyrotoxic. However, to say that these patients have no residual evidence of their previous condition is to deny the facts. This is usually in the form of nervousness and palpitation, especially in an emergency. We have included here also those cases of persistent exophthalmos of such degree as to be a constant annoyance. This entire group of patients is, however, completely rehabilitated. They carry on their activities in much the same manner as before their illness began. Group 3 represents those patients with severe cardiac damage who are partially rehabilitated, but who are not symptom free because of residual visceral changes. In Group 4 are those patients who had to take small doses of thyroid extract postoperatively. Thus it can be said

that Groups 1, 2, 3 and 4 are surgical successes inasmuch as surgery accomplished its purpose—the relief of the thyrotoxicosis.

Group 5 includes those patients with residual hyperthyroidism—that is, they were still toxic at their first follow-up examination at four months. Group 6 represents patients who were entirely well for a while but developed recurrent hyperthyroidism. Thus, of the diffuse toxic goiter series, 6.6 per cent had residual toxicity—that is, they were still toxic at their first follow-up examination, and 3.4 per cent developed recurrent toxicity after having been well for a while. This makes a total of 10 per cent of patients who have had thyrotoxicosis after operation. If only those patients who were followed for two or more years were considered, this would be 12 per cent. Many of these patients, however, were only mildly toxic and required very little treatment. Table V shows what happened to these 47 patients. Groups 5 and 6 are classed together since from the standpoint of treatment they present the same problem.

TABLE V

Result in Residual and Recurrent Hyperthyroidism

10 controlled by 1 course (1–6 months) of iodine
6 controlled by continuous small doses of iodine
11 controlled by roentgen ray
7 controlled by reoperation
13 toxic when last seen
  6 toxic at first visit, given iodine and not seen again
  1 toxic at first visit, given roentgen ray and not seen again
  2 advised to have another operation,—refused
  3 carried along on iodine and roentgen ray for two to five years. Still slightly toxic.
  1 still toxic after roentgen ray and reoperation.

47 Total

Thus, of the cases of residual or recurrent hyperthyroidism only four who followed the advice given were not relieved of their toxicity within one year. Three of these are able to carry on their work but remain in a state of chronic thyrotoxicosis hardly severe enough to warrant further operation. The fourth refused a second operation and was quite toxic when last seen. So while 10 per cent of the series had some toxicity after operation, only 2.7 per cent of the series were toxic when last seen and less than 1 per cent who gave reasonable coöperation were not completely relieved of their thyrotoxicosis.

TABLE VI

Diffuse Toxic Goiter

Residual or recurrent hyperthyroidism but relieved by iodine or roentgen ray	5.7 per cent
Reoperation performed or advised	2.1 per cent
Hyperthyroidism not entirely relieved after reasonable coöperation	.9 per cent

The series of nodular toxic goiters includes 202 patients, 39 of whom were excluded from our study because of the lack of a follow-up examina-

tion. Here the results of surgery are much better than with diffuse toxic goiter, because the portion of the gland to remove and the portion to leave behind is usually well indicated. In the entire series only one patient developed recurrent hyperthyroidism. It is of a mild type and is controlled by small doses of iodine.

TABLE VII

End-results in Nodular Toxic Goiters

F. U.	No.	Well	Resid. Sympt.	Resid. Visc. Changes	Hypo-Thyroid	Resid. Tox.	Recur. Tox.
2–5 yrs.	93	79	8	4	1	0	1
1–2 yrs.	43	38	4	0	1	0	0
4–12 mos.	27	24	3	0	0	0	0
Total	163	141	15	4	2	0	1

In our clinic a conservative stand has been taken as to the amount of thyroid to leave at operation. We have not followed the teaching of Richter[4] who advocates doing almost a total thyroidectomy and feeding thyroid extract postoperatively as a routine procedure, although he reports less than 1 per cent of recurrent hyperthyroidism. It has been felt that it is better to have a few cases of residual hyperthyroidism than to have many cases of hypothyroidism. Certainly the former condition is much easier to relieve completely.

Most of the large clinics in this country have done conservative thyroid surgery. The Lahey Clinic[2] reports an incidence of residual and recurrent hyperthyroidism in 12 per cent of 100 cases followed for five years. These were equally divided between residual and recurrent cases. Coller and Potter,[3] of the University of Michigan, reported 5 per cent of recurrences.

The operative mortality has been reduced to such a low level as to figure very little in end-results. We believe that the greatest advance in thyroid surgery since the advent of iodine as a preoperative measure has been the use of glucose intravenously as a postoperative measure. Since the introduction of this treatment in our clinic the operative mortality for all thyroid cases has been 0.6 per cent.

SUMMARY

(1) The end-results of 467 cases of diffuse toxic goiter and 163 cases of nodular toxic goiter have been reviewed.

(2) In the series of diffuse toxic goiters there was residual toxicity in 6.6 per cent, and recurrent toxicity in 3.4 per cent of the cases, giving a total postoperative hyperthyroidism of 10 per cent.

(3) Reoperation was performed or advised in 2.1 per cent of the diffuse toxic goiter series.

(4) With a reasonable amount of coöperation on the part of the patient with diffuse toxic goiter, complete relief of thyrotoxicosis may be expected

in 99 per cent of patients by means of conservative surgery which will have to be followed by iodine, roentgen ray, or reoperation in a small per cent of cases.

(5) In the series of nodular toxic goiters, there was recurrent hyperthyroidism in 0.6 per cent of cases.

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OPERABILITY OF CARCINOMA OF THE STOMACH

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The operability of carcinoma of the stomach seems worthy of discussion for the reason that the opinion is still held by many, including physicians, that carcinoma in this situation is necessarily a fatal disease. It is quite true that the operability of carcinoma, in terms of resection of the growth, has not been high, and as the end-results in general of the surgery of carcinoma of the stomach are reviewed one is apt to allow the relatively high inoperability to obscure the benefits of resection in the truly operable tumors.

The American Society for the Control of Cancer has recently provided me with certain data which emphasize the importance of cancer of the stomach. These data are for the year 1930 for the continental registration area, which includes the District of Columbia, but does not include Texas. In 1930, there were 115,265 deaths from cancer, all organs; there were 25,408 deaths from cancer of the stomach and duodenum, which represents 22 per cent of all deaths from cancer. Inasmuch as primary carcinoma of the duodenum is exceedingly rare, it may be reasonably assumed that the number of deaths from cancer of the stomach and duodenum was almost entirely due to carcinoma of the stomach.

In 1881, Billroth[2] probably performed the first gastric resection for carcinoma of the stomach, since which time partial gastrectomy has become a well-established procedure in dealing with operable malignant disease of the stomach. Throughout these years the fundamental principles of Billroth in the performance of partial gastrectomy and the restoration of the gastro-intestinal continuity have remained unchallenged except in detail of execution. The various methods of restoration of continuity, as advocated by Kocher, Pólya, Balfour[1] and others are not radical departures from the original Billroth I procedure in which, following the gastric resection, the stomach and duodenum are reunited, or the Billroth II, in which, following the resection, the ends of the stomach and duodenum are closed and continuity established by posterior gastrojejunostomy. Today, these latter procedures remain methods of choice in the restoration of continuity following resections of the pyloric third of the stomach. The method of Pólya or its various modifications are applicable in gastric resection above the pyloric third of the stomach, in which the stomach and duodenum are not readily reunited, or in which posterior gastrojejunostomy is not readily accomplished.

Even though the diagnosis of carcinoma of the stomach has reached a high degree of accuracy with the advent and perfection of roentgenologic examination of the gastro-intestinal tract, the operability of malignant lesions in this situation remains very low. It is extremely difficult for the most able

clinician to make an early diagnosis or a diagnosis of early carcinoma of the stomach, usually because the signs and symptoms are entirely lacking or are most insignificant in the early stages of the disease. Likewise, there may be few symptoms even in well-advanced malignant disease of the stomach in the absence of encroachment of the lesion on the cardia or pyloric outlet. Unfortunately, the disease often is well advanced, and either by virtue of its location, extent or metastases is not removable even at the time of the first manifestation of symptoms. A high lesion situated at the cardia or along the upper lesser curvature precludes removal even in an early stage of the disease while it is still confined as an intrinsic lesion. Gatewood[3, 4] has recently stated that in 14.4 per cent of the cases of carcinoma of the stomach the growth was situated at the cardia. Clinical manifestations of inoperability of the lesion are often present at the time of initial examination. The palpable firm, often fixed, sentinel gland in the left supraclavicular area, infiltration of the umbilicus, the irregular, firm, nodular rectal shelf, an enlarged, hard, nodular liver, associated jaundice, or ascites often provide sufficient clinical evidence of metastasis to denote inoperability. A large, palpable, immobile carcinomatous tumor of the stomach, particularly if situated largely to the left of the midline and extending under the left costal margin, is seldom justifiably explored with much prospect of its removal. Most valuable in the determination of operability of carcinoma of the stomach in the absence of clinical manifestations of inoperability is the intrinsic extent of the growth as determined by fluoroscopic and roentgenologic examination.

By the foregoing determinations clinical inoperability has been in excess of 50 per cent of all cases of carcinoma of the stomach. A study of statistical material reveals a wide variation of operability which in many instances is based not only on removability of the growth, but also on palliative surgical procedures. Quoting from several authors, acceptance for surgical procedures in various hospitals has varied from as low as 30 per cent to 70 per cent of all cases of carcinoma of the stomach. (Maes,[7] Boyce and McFetridge, 30 per cent; Gatewood,[3, 4] 50 per cent; Balfour,[1] 50 per cent; St. John,[10] 67 per cent; Lahey,[6] 70 per cent.) A similarly wide variation exists in regard to operability in terms of resection or removal of the growth, from 16 per cent to 47 per cent of the cases in which surgical exploration was carried out. (St. John, 16.4 per cent; Maes, Boyce and McFetridge, 17 per cent; Gatewood, 28 per cent; Persson,[8] 31.4 per cent; Balfour, 43 per cent; Lahey, 47 per cent.) Reviewing my own experience in 149 cases of carcinoma of the stomach operated upon during the last ten years, which includes those cases operated upon at St. Vincent's Hospital during the past four years and those that I explored on my service at the Mayo Clinic previous to 1930, the operability, in terms of resection, was 36.2 per cent of the patients explored. The operability has varied but slightly. (36.1 per cent previous to 1930, and 36.8 per cent during the last four years.) To complete the survey, the operability in terms of the curative procedure of resection or partial gastrectomy in patients seen with cancer of the stomach has varied from 4.8 per

cent to 33 per cent. (Maes, Boyce and McFetridge, 4.8 per cent; Gatewood, 14 per cent; St. John, 16.4 per cent; Balfour, 22.6 per cent; Lahey, 33 per cent.)

Operability in terms of resection has in recent years increased materially in the hands of those particularly interested in the surgical treatment of carcinoma of the stomach. Persson,[8] of Stockholm, in reviewing 1,150 cases of carcinoma of the stomach that had been operated on during the forty-year period from 1887 to 1926, showed that the operability in terms of resection of the stomach increased from 20 per cent in 1901, to 40.9 per cent in 1926. Balfour has likewise recently stated that in the decade 1920 to 1930, resection was possible in 43.16 per cent of the cases in which exploration was carried out, as compared with 39.3 per cent of the cases in the previous decade, 1910 to 1920.

Mortality Rate of Resection.—Persson has shown that with the increasing frequency of resection the mortality rate of gastric resection increased during the two decades, 1906 to 1926, from 25 per cent to 38 per cent. Gatewood, in 1930, reported a mortality rate of 32 per cent for gastric resection, but in 1932 stated that in recent years the mortality rate had been reduced to about 18 per cent. Balfour, in 1932, reported the remarkable series of 200 cases of partial gastrectomy with but ten deaths in the hospital. Unquestionably the employment of methods during recent years for the rehabilitation of patients with carcinoma of the stomach previous to surgical exploration has contributed greatly to reduction of the risk of gastric resection. Repeated gastric lavage for gastric retention, the intensive administration of glucose and of physiologic solution of sodium chloride to combat dehydration and restore the normal balance in the chemistry of the blood, and the preoperative treatment of secondary anemia by blood transfusion, are most important in the improvement of the general condition of the patient before operation and reduction of the risk of surgical procedure. Experience has shown that partial gastrectomy for malignant disease can be accomplished within a mortality rate of 10 per cent. A tendency exists among many surgeons to extend the scope of partial gastrectomy, beyond what may reasonably be accepted as operable lesions. While many factors influence the risk of partial gastrectomy, it is well known that mortality rate rises rapidly for partial gastrectomy above the pyloric half or two-thirds of the stomach. The question of total gastrectomy at times presents itself to the surgeon, in which extensive malignant disease, apparently entirely confined to the stomach, as determined upon exploration, may be removed by a resection to the esophagus. The instances where this question arises are infrequent. Total removal of the stomach with anastomosis has been successfully accomplished in a number of instances. The mortality rate of the procedure will of necessity always be high, but the risk at times may be entirely justifiable. Roeder[9] has recently reported three cases of total gastrectomy with two deaths. A mortality of 50 per cent occurred in 88 cases of total gastrectomy this author collected from the literature. Total removal of the stomach for cancer is

justified only in those cases in which the stomach can be sufficiently mobilized to provide access to the esophagus that an accurate anastomosis can be made between the esophagus and the jejunum.

Palliative Surgical Procedures.—While partial gastrectomy is the only curative procedure for carcinoma of the stomach in the truly operable cases, it may at times be advantageously employed as a palliative measure. Palliative partial gastrectomy for the highly malignant fulminating type of carcinoma, which is resectable to the exclusion of metastases, seldom offers much palliation and usually fails to prolong life. However, in lesions of relatively low-grade malignancy, which progress slowly and are entirely operable so far as the primary lesion is concerned, even though involved regional lymphatics are left behind, a partial gastrectomy at times results in unexpected prolongation of life and sufficient comfort to justify the procedure.

The operation of gastro-enterostomy has frequently been used as a palliative procedure in the treatment of cancer of the stomach with a mortality rate approximating that for gastric resection. (Maes, Boys and McFetridge, 43.6 per cent; Gatewood, 25.9 per cent.) In fact, gastro-enterostomy was employed in a much larger number of cases than resection in the reported series of Persson, Gatewood, St. John, [10, 11] and Maes, *et al.* Gatewood, in summarizing the postoperative results of gastro-enterostomy, stated that all patients were dead and that the average postoperative length of life of those surviving the operation was a little less than nine months, or a little more than two and one-half months longer than those in whom upon exploration the condition was considered inoperable to any surgical procedure. It may be justly assumed, it seems, that in many instances a palliative gastro-enterostomy allows a patient to live longer that he may suffer more. More or less definite indications and contra-indications may be established for palliative gastro-enterostomy. Such short circuiting of a highly obstructive lesion not resectable for one reason or another has resulted in many instances not only in prolonging life many months, but general improvement with resumption of a regular diet. In the absence of pyloric occlusion by an inoperable carcinoma of the stomach, palliation is usually not obtained by gastro-enterostomy. Uncertainty as to the true nature of the gastric lesion even in the absence of pyloric obstruction or gastric retention may at times justify gastro-enterostomy. I have been much impressed in several instances to observe permanent improvement with disappearance of a large gastric lesion, not resectable, and presumed to be carcinoma, the subsequent events proving that the lesion was benign.

The question of gastrostomy or jejunostomy for feeding purposes in the presence of an obstructing carcinoma at the cardiac orifice of the stomach is one not easily answered. Assuming that the diagnosis of carcinoma is correct the responsibility for such palliative procedures rests largely with the patient or members of the family. In general, it may be stated that palliative surgical procedures are seldom warranted when clinical manifestations of metastasis or inoperability exist. Upon exploration the determination of

inoperability should preclude palliative operations unless the reasonably anticipated palliation justifies the risk.

Prognosis Following Gastric Resection.—Once a partial gastrectomy has been done for carcinoma, considerable uncertainty exists regarding the result that may be expected from the operation. Of first importance is the question of whether or not the resection has been sufficiently wide to include not only the primary lesion, but any and all involved regional lymph-nodes. Prognosis is also dependent upon whether undetectable metastatic lesions elsewhere are present at the time of operation. There are many factors which influence prognosis, most of which are intangible and difficult of interpretation in the individual instance.

Gray has recently made an important contribution on the clinical and pathologic factors influencing ultimate prognosis following resection for carcinoma of the stomach. His study was a comparative one on a series of 373 cases in which resection of the stomach had been done; in 100 cases the patients did not survive longer than 12 months after operation; in 145 cases the patients had lived more than five years; and in 128 cases the patients had lived longer than ten years. He concluded that from a clinical standpoint, sex, age, familial history of malignancy, the general condition of the patient, and the total quantity of gastric content are inconclusive so far as prognosis is concerned; that a short history is a grave prognostic sign, since it suggests a rapidly progressing process, and the presence of anacidity must be considered with some apprehension. From a pathologic standpoint he further concluded that the three most important factors that decrease the possibility of a long postoperative life are involvement of the lymph-nodes and the serosa, and a tumor of high-grade malignancy, of which the grade of malignancy is the most important.

Results of Resection.—It has been shown that operability in the past has not been great and that the mortality rate in general has been relatively high. It has also been shown that in recent years there is a gradual tendency toward higher operability and a definite reduction of mortality rate for the operation of gastric resection for carcinoma. It is well known that many intangible factors influence prognosis. What has been the result of resection? Some idea may be obtained by following through in the series of cases of a few of the authors previously quoted. Persson, of Stockholm, in 1927, reported that 19 per cent of the cases surviving resection lived five years or more. Less than one-third of these died from recurrence more than five years after operation; but 8.5 per cent of the cases surviving resection were living and well six and one-half years to 20 years after operation. St. John, in 1927, stated that 21 per cent of all cases of carcinoma of the stomach surviving resection were alive and well after the five-year period. Gatewood, in 1932, stated that 46.1 per cent of patients who survived the operation lived more than three years, and 39.5 per cent survived more than five years. Balfour, in an analysis of 128 patients who lived ten years or more following opera-

tion, said that they represented about 20 per cent of the patients for whom resection could be carried out.

The curability of carcinoma of the stomach has been established. The surgical procedure of partial gastrectomy with the various methods of restoring gastro-intestinal continuity has a wide range of applicability for lesions of the stomach including the regional glandular structures. Adequate preoperative preparation of patients debilitated by gastric retention, dehydration, or anemia materially reduces the risk of resection. Partial gastrectomy offers the patient the only possibility of cure. Only through investigation of the significance of digestive symptoms in the adult patient by competent roentgenologic examination may the future operability of carcinoma of the stomach be increased. Opportunity exists to increase the curability of this disease and it is probable that this will come about through its earlier recognition and not through extension of operability through higher gastric resection or total gastrectomy. There is a justifiable and acceptable mortality for gastric resection for malignant disease which will vary with the individual surgeon, but as a general working rule this should seldom exceed the percentage prospect of cure.

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SARCOMA OF THE STOMACH

A REPORT OF NINE CASES

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It is generally known that the mortality from gastric cancer exceeds that from malignant tumors occurring elsewhere in the body. An overwhelming majority of malignant tumors of the stomach is made up of carcinomata. The occurrence of lymphosarcoma, fibrosarcoma, myosarcoma and neurosarcoma in the stomach is of great rarity although it has its share of mesodermal tissues. The first case report of a gastric sarcoma was published by Bruch in 1847. Virchow in 1863 described three myosarcomata of the stomach. Askey[2] summarized all available case reports of gastric sarcoma in the literature up to 1931, which included only 335 tumors. At the Memorial Hospital there were only five sarcomata found in 400 malignant tumors of the stomach and in 40,000 applications for treatment of benign and malignant neoplasms of all organs. This agrees with the commonly quoted frequency of gastric sarcomata, namely 1 per cent. of malignant gastric tumors. Fenwick's[26] incidence of 5 to 8 per cent. of all malignant gastric neoplasms is questionable; possibly some of his tumors were small round-cell carcinomata, which are difficult to distinguish histologically from certain gastric sarcomata. We shall report our own experience with these unusual tumors of the stomach and in addition include three case reports from the New Haven Hospital and one from the service of Doctor McWhorter[47] in the French Hospital, New York.

Etiology.—The gastric lymphosarcomata originate from the lymphoid follicles of the submucosa. Ewing[25] is of the opinion that lymphosarcoma may begin as an inflammatory process, a theory which seems especially true in the case of gastric lymphosarcoma. In discussing the origin of this tumor in the stomach, Ewing states that the following questions must be answered. Is it part of a leukemic process? Is it part of a gastro-intestinal pseudoleukemia? Is it part of a generalized lymphosarcoma? Or is it solely a localized tumor? These diseases are so interrelated that one cannot always categorically define the particular lesion found in the stomach, but the questions are best answered by clinical findings, blood studies, biopsy and the subsequent course of the disease.

Embryonal rests after the theory of Cohnheim have been suggested by Antonow[1] and Lubarsch[46] as a probable etiological factor. This explanation seems eminently suited for the myomata, myosarcomata and neurogenic tumors of the stomach and gains credence because of the fact that these neoplasms are often multicentric. Degeneration of benign leiomyomata into

myosarcomata may occur in the stomach just as in the uterus, although probably with greater frequency (Brereton,[8] Kleinknecht[42]). Every large fibroid tumor of the gastric wall should be suspected of having malignant qualities (Case IV).

The question arises if sarcoma ever develops on the basis of a peptic ulcer? It seems possible that sarcoma may follow ulcer although it has not been satisfactorily proven. Ewing cautions against the interpretation as sarcoma of any tumor associated with ulcer or whose gross appearance suggests carcinoma.

Trauma cannot be accepted as an important contributory cause unless several conditions can be complied with, such as a proper time interval between

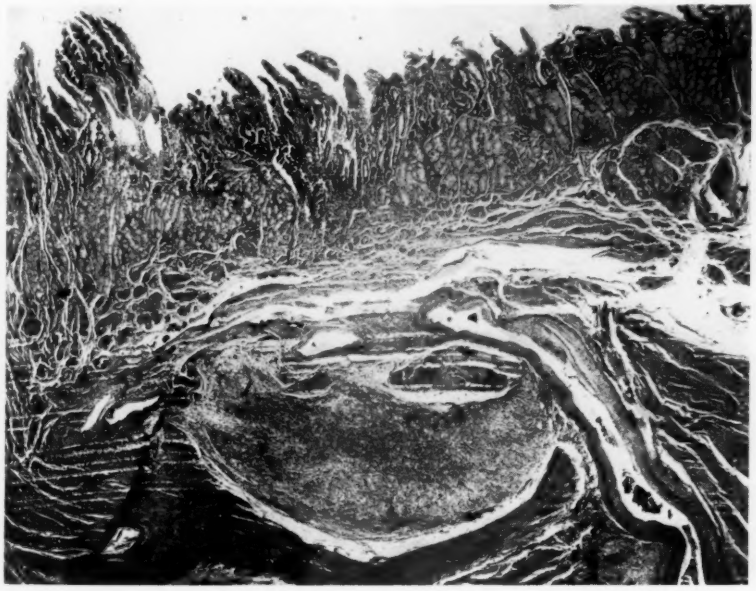

FIG. 1.—Neurofibroma of stomach. Intramural location between muscular layers.

the injury and the development of the sarcoma and the certainty that there was not a preëxistent tumor at the time the trauma was sustained. G. S. McWhorter's patient had previously received a violent kick in the abdomen by a mule.

Sex.—Cheever,[13] Douglas,[23] Flebbe,[29] Ziesche and Davidsohn found the sexes to be equally involved by gastric sarcoma whereas Askey in 335 collected cases reported 70 per cent. in males. Balfour's[4] patients were 57 per cent. males. Of the nine tumors which we are reporting, six were in males. It seems that the male preponderance which exists in carcinoma of the stomach to the extent of 69 per cent. also obtains in gastric sarcoma.

Age.—The ages of the patients in our small series are 24, 28, 32, 46, 52, 53, 54 and 65 years. The average age of 46 years agrees with that reported by other authors, *viz.*, Brereton 41, Askey 41, D'Aunoy[20] 41.6, Balfour 43, Hesse 44.5, Broders[9] 46.25, and Cheever 53.5 years. The average age of

our 400 patients with carcinoma of the stomach was fifty-four years, a difference of eight years. This is in keeping with the prevalent opinion that sarcomata generally occur in younger subjects although Crohn[16] states that the greater number of cases occur in the fifth and sixth decades and quotes the figures of Hesse, Ziesche and Davidsohn to prove his contention.

	Hesse	Ziesche and Davidsohn
First decade	1.5%	3%
Second decade	6.7%	11%
Third decade	18.0%	18%
Fourth decade	13.4%	15%
Fifth decade	24.0%	29%
Sixth decade	20.3%	24%
Seventh decade	10.3%	12%
Eighth decade	5.2%	6%

Finlayson's[27] patient, a three and one-half year old child, is probably the youngest on record to have sarcoma of the stomach. This tumor ran a fulminating course, as is usually the case in youthful subjects.

Classification of Sarcomata of Stomach

Histogenesis	Site	Symptomatology
1. Spindle-cell Sarcoma	1. *Exogastric.* Most frequent. Greater curvature. Usually pedunculated. Low degree of malignancy.	1. Latent form with no gastric symptoms rare.
(*a*) Neurosarcoma.		
(*b*) Myosarcoma more common.		2. Abdominal tumor without gastric symptoms. Usually exogastric sarcomata which are large and of slow growth.
	2. *Intramural.* Less frequent. Higher degree of malignancy. Pylorus occasionally involved.	3. Abdominal tumor with symptoms of gastric ulcer or carcinoma.
2. Lymphosarcoma.	1. *Intra-Gastric.* Small. Vascular. Pedunculated or polypoid. Long duration. Low grade of malignancy. Occasionally at pylorus. Rare.	1. Abdominal tumor with no gastric symptoms.
(*a*) Primary in stomach.		2. Abdominal tumor with gastric symptoms.
		a. Gastric symptoms only.
(*b*) Generalized lymphosarcomatosis.	2. *Intra-mural.* Infiltrating type resembling linitis plastica. Sometimes submucous with giant rugae.	b. With clinical evidence of generalized lymphosarcomatosis.
3. Miscellaneous round cell or alveolar sarcoma.	1. *Intramural.* Less common. Usually infiltrating.	1. Abdominal tumor with or without gastric symptoms.
Metastatic sarcoma such as melanoma.	2. *Submucous.* Often ulcerated.	

An interrelated classification has been used because the histologic structure and locations of these tumors largely determine the character of the symptoms.

Gross Pathologic Anatomy.—Lymphosarcoma in the stomach may exist as a bulky, vascular polypoid tumor clearly demarcated from normal stomach wall, or as an ulcer with surrounding infiltration of indeterminate extent (Fig. 8), or as multiple small nodular tumors in the submucosa or as a diffuse rubber-like thickening of the gastric wall with no demarcation or nodularity. This last type is common and grossly resembles the gastric carcinomata of the linitis plastica type except that the stomach is not so contracted and the rugae of the lymphosarcomatous stomach are sometimes the seat of giant hypertrophy (Fig. 5). On section, the lymphosarcomata are soft and lardaceous with multiple foci of necrosis and interstitial hemorrhage. The muscularis is invaded and perforation is more frequent than in carci-

FIG. 2.—Myogenic sarcoma of stomach.

noma. Ewing believes these tumors tend to ulcerate when they have grown beyond their blood supply. They invade the submucosa and stretch the mucosa which also undergoes pressure atrophy and multiple ulceration (Case VII).

Neurogenic sarcomata in the stomach have no specific features because of their location. They are usually associated with visceral neurofibromatosis (Fig. 1). These rare tumors are intramural or subserous in their location.

The myosarcomata, intramural at first and later usually subserous in their growth, frequently attain enormous size. Brereton's tumor weighed twelve pounds. Brodowski mentions an exogastric myosarcoma weighing six kilograms and containing six litres of fluid. G. S. McWhorter described such a tumor measuring 37 by 28 by 16 cm. and containing 2,500 cc. of fluid.

Although the polypoid multiple myomata are usually on the interior of the stomach, the large myosarcomata are more commonly exogastric, such as the tumor weighing 3,600 grams reported in Case IV. They grow under the serosa and become pedunculated because of their great size and weight. These large tumors, originating from the greater curvature of the stomach, spread between the layers of the great omentum and so may give the false impression of inoperability when first examined by the surgeon. The mucosa in these cases has nothing to do with the sarcoma and so is preserved. There is a tendency to central necrosis and hemorrhage in these large myosarcomata due to their rich blood supply. This central necrosis may result in extensive abscess formation (Schiff[56] and Foulger, Lubarsch, Kaufmann[40]).

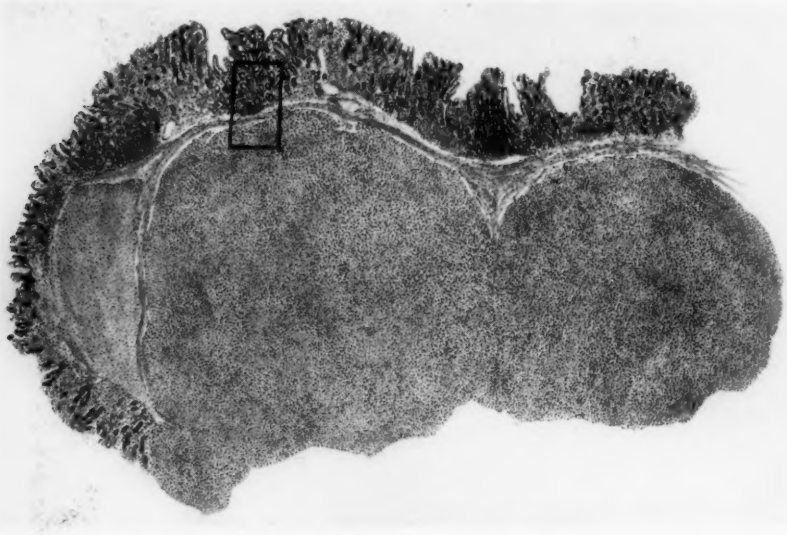

FIG. 3.—Myogenic sarcoma of stomach.

Other degenerative changes which occur are: calcification, gelatinous and hyaline metamorphosis.

Pathologic Histology.—The relative frequency of the different histologic types of gastric sarcoma is uniformly given by several authors:

	Lubarsch	D'Aunoy	Douglas
Lymphosarcoma	40%	39%	49%
Spindle-cell sarcoma	20%	14%	19.5%
Myosarcoma	16%	6%	....
Other types	24%	17%	25.5%

The lymphosarcomata originating in the lymphoid follicles of the submucosa are practically always reticulum cell sarcomata, rarely the malignant lymphocytomata. Their microscopic appearance is typical of lymphosarcoma in general. We are showing in microphotographs the sarcomatous changes in these lymph follicles and the diffuse infiltration of the entire thickness of the stomach wall (Fig. 6 and 7).

The microscopic architecture of neurosarcomata is not remarkable, differing in no respect from these tumors of somatic distribution.

The myosarcomata vary greatly in structure from the very cellular myomata of questionable malignancy (Case IV) to the anaplastic undifferentiated tumors of high malignancy (Figs. 3 and 4). They may be composed of large round cells or spindle cells often arranged in intertwining bundles or grouped about blood vessels. These tumors may be confused with the spindle-cell carcinomata unless the latter exhibit alveolar formation. The cells of myosarcoma are sometimes long with finely fibrillar, acidophilic cytoplasm and hyperchromatic nuclei, which are sometimes monstrous (Fig. 2).

FIG. 4.—Myogenic sarcoma of stomach, low magnification. An encapsulated tumor, not involving mucosa or muscularis mucosa. (See Fig. 3.)

Regional Distribution.—The subserous pedunculated exogastric tumors arise mostly from the greater curvature or from the anterior or posterior wall near the greater curvature. Of Balfour's fifty-four cases, the majority were situated on the lesser curvature; Lubarsch on the contrary was of the opinion that sarcomata seldom occur on the lesser curvature. The lymphosarcomata and other ulcerating sarcomata do occur in this location, where they may clinically and roentgenographically simulate benign penetrating peptic ulcers. The orifices are seldom obstructed, hence gastric and esophageal dilatation are unusual. Pyloric stenosis is occasionally due to involvement by the diffuse infiltrating variety of lymphosarcoma, although more often the pylorus is rigidly patent (Case VII).

The percentage distribution has been analyzed by various authors from collected case reports in literature:

	D'Aunoy	Douglas (Flebbe)	Crohn (Lofaro)
Greater curvature	17%	20.5%	25.4%
Lesser curvature	16%	17.7%	13.2%
Pylorus	16%	25.3%	18.8%
Posterior wall	12%	8.9%	19.8%

	D'Aunoy	Douglas (Flebbe)	Crohn (Lofaro)
Anterior wall	..	5.5%	9.4%
Anterior and posterior wall	11%	....	....
Fundus	1%	....	0.9%
Pylorus and both curvatures	..	1.3%	....
Diffuse infiltration	11%	18.5%	18.8%
Cárdia	..	2. %	2.8%

Signs and Symptoms.—Any discussion of symptoms must of necessity combine the factors inherent in the different varieties of gastric sarcomata and the locations of the lesions. We have summarized the symptomatology under the classification of gastric sarcomata. The bulky exogastric sarcoma may first be discovered as a palpable abdominal tumor before provoking any symp-

FIG. 5.—Lymphosarcoma of stomach. The largest human stomach we have ever observed, measuring thirty-six centimeters in length. One discrete spherical tumor, with diffuse extension of the lymphosarcomatous process to involve all the giant rugae.

toms; these symptoms, when occurring, are due either to pressure by the tumor or rarely to necrosis, hemorrhage or infection within the tumor (Case IV), in which case the symptoms are more acute. The onset may be insidious or may be precipitated with extreme suddenness and violent illness accompanied in rare instances by chills and fever.

Patients with lymphosarcoma of the stomach not infrequently present themselves with histories typical of ulcer pain (Cases VI and VII). Subsequent to a gastro-intestinal series of roentgenograms showing an ulcer, they may come to operation receiving a gastro-enterostomy or other plastic opera-

tions, only, shortly after convalescence to return again for observation complaining of pain as before and in addition an upper abdominal tumor. (Case II. No. 2). Perforation of these ulcerating sarcomata is more common than in carcinoma. There should be no marked pain unless there is ulceration of the mucosa. The intramural and endogastric tumors, notably the myogenic and neurogenic sarcomata are slow to involve the mucosa, on which account pain and vomiting are not early complaints.

Some patients complain of extreme weakness, rapid loss of weight, tarry stools, acute abdominal pain, nausea and vomiting, with or without hematemesis; the majority of these patients have palpable abdominal tumors. Attention has previously been called to the fact that sarcomata usually do not obstruct the orifices of the stomach so that dysphagia and vomiting are not

FIG. 6.—Low power microphotograph of cross-section of stomach through the giant rugae seen in Fig. 5. The lymphosarcoma is seen to involve all layers of the stomach, especially the submucosal and subserosal layers.

common occurrences, yet 50 per cent. of Balfour's patients complained of vomiting. Hematemesis and melena are said to be more frequent in the submucous and round-cell sarcomata, occurring in approximately 30 per cent. of the cases and occasionally ending fatally.

Gastric lymphosarcoma may be accompanied by generalized superficial lymphadenopathy, a relative lymphocytosis of the blood, splenomegaly (10 per cent.) and other well-known features of lymphosarcomatosis. Kundrat's sign (swelling of lymphoid follicles at base of tongue) may be present.

Diagnosis.—It is almost impossible clinically to distinguish sarcoma from carcinoma of the stomach, although Balfour correctly diagnosed two of his fifty-four cases preoperatively. The very large exogastric sarcomata have been confused diagnostically with splenomegaly, ovarian and mesenteric cysts, hydatid cyst, liver abscess and Banti's disease. Gastric syphilis and

chronic productive gastritis have been clinically, roentgenographically and microscopically diagnosed incorrectly as sarcoma. Haggard[34] has said that hematemesis in a young person with or without severe pain and a palpable epigastric tumor without obstructive symptoms may signify gastric sarcoma. Pain, vomiting and obstructive symptoms are generally less frequent with sarcoma than carcinoma of the stomach. The occurrence of definite tarry stools, associated with gastric symptoms but negative roentgenograms of the stomach is suggestive of sarcoma. The size of a tumor is no criterion of its histologic

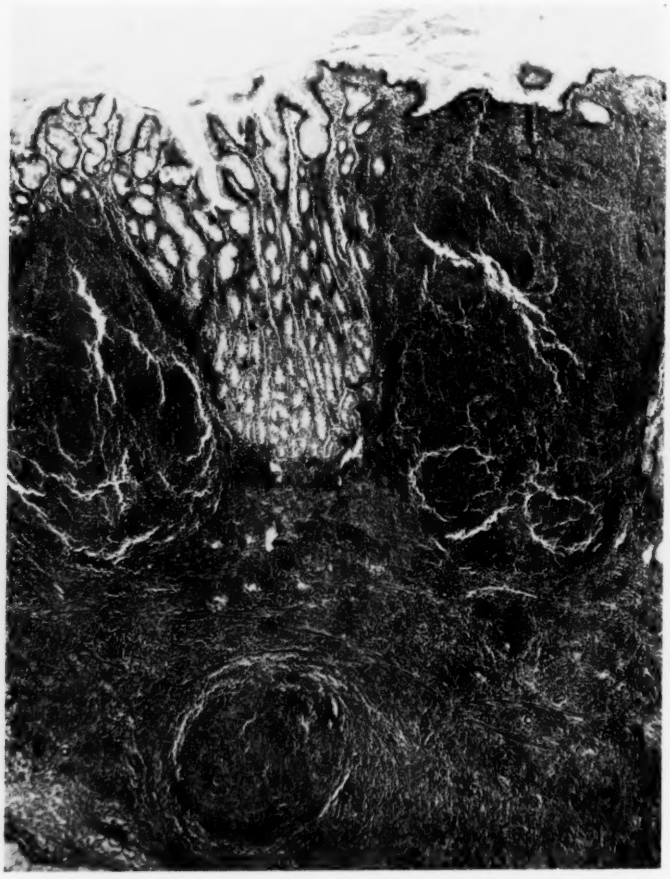

FIG. 7.—Lymphosarcoma of stomach. To show invasion of mucosal and submucosal layers.

structure (Case IV), yet the gastric sarcomata are usually larger, more easily palpable and more movable than the average gastric carcinoma. Gastric sarcomata are palpable in 33 per cent. of the cases (Meischke[48]). The free hydrochloric acid in the gastric contents may be normal or excessive. The diagnosis has been made from tissue secured in the vomitus. Gastroscopy sometimes reveals submucous hemorrhages in the case of lymphosarcoma of the stomach. Schlesinger[57] states that the stomach involved by sarcoma will

not dilate when insufflated, but neither will the stomach occupied by a diffuse fibro-carcinoma.

Roentgen-ray Diagnosis.—There are no specific radiographic features of gastric sarcoma. The subserosal sarcomata, particularly when pedunculated, produce no filling defects other than that caused by extrinsic pressure. Fluoroscopy aids in determining the exogastric location of such tumors. Sarcomata are far less prone than carcinomata to obstruct the pylorus and cardia, in fact the orificial lumen in the sarcomatous stomach is frequently found to be enlarged. There are so many types of gastric sarcomata and different

FIG. 8.—Secondary lymphosarcoma in stomach. Two ulcerated discrete tumors may be seen.

regions of involvement that we cannot label any radiographic sign as more than suggestive. For example, horizontal defects due to the presence of giant rugae are sometimes present with lymphosarcoma. Some gastric polyps are lymphoblastic which together with other mucosal tumors may be tentatively considered as sarcomatous when peristalsis persists and passes over the involved stomach wall. This is probably due to late invasion of the muscular coat by sarcoma. An ulcer on the lesser curvature in combination with a palpable epigastric tumor, usually movable, may be either carcinomatous or sarcomatous.

Metastasis.—The manner and route of dissemination of gastric sarcomata depend on the histologic type of tumor and its regional location. Examples are known to prove that the spread of the disease may occur via the blood and

lymph circulation and by direct extension. With the exception of lymphosarcoma, metastasis is seldom as early and extensive as in the case of carcinomata of the stomach. Published analyses of the widespread dissemination of sarcomata of the stomach are misleading, because many of these tumors are lymphosarcomata which involve the stomach incidentally but do not necessarily originate in the organ. (Cases VIII and IX.) The frequency of metastasis has been given rather uniformly by several authors: Ransohoff and Dickson[52] 33 per cent., Haggard 40 per cent., Reeves[53] 30 to 40 per cent., Broders 50 per cent., Kaufmann 33 per cent., Frazier[30] 40 per cent., Fenwick 70 per cent., Demel[21] 33 per cent., Lubarsch 60 to 70 per cent., Corner and Fairbanks[15] 40 per cent.

The perigastric lymph nodes and liver are usually the first sites of metasta-

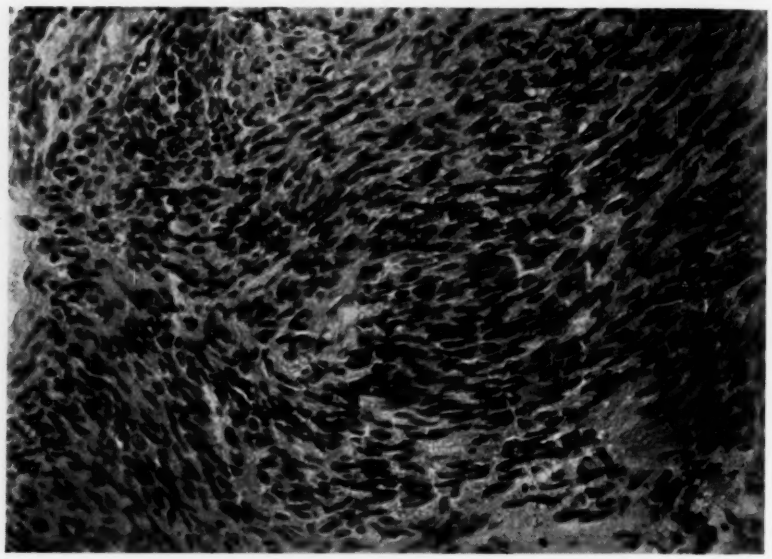

FIG. 9.—Cellular myoma of stomach. (Case IV.)

sis of lymphosarcoma. The order of frequency in which the various organs are involved by metastasis has been listed by Flebbe as follows: Regional and mesenteric lymph nodes, liver, mesentery, colon, peritoneum, omentum, ovary, pancreas, bones, pleura, lung, testicle, spleen, diaphragm, kidney, adrenal and skin. Fenwick, on the other hand, found skin metastases in twelve per cent. of his collected cases.

Duration and Course.—It is difficult to generalize about the life expectancy of gastric sarcomata because of their various histogenesis and locations. Such authorities as Ewing, Lubarsch and Kaufmann, agree that the average sarcoma of the stomach runs a longer course than carcinoma. The average duration of untreated cases, analyzed from case reports in literature is eighteen months. Myosarcomata are often slowly growing bulky tumors, slow to metastasize and of a low degree of malignancy, although occasionally the

patient with such a tumor may become acutely ill with fever and prostration and live only a few days.

Prognosis.—The life expectancy of patients suffering from gastric sarcoma should be in some respects better than for carcinoma of the stomach. The outlook for the successful treatment of spindle-cell sarcoma, myogenic or neurogenic and usually exogastric in location is particularly hopeful when we realize the fundamental nature of the tumor with which we are dealing. The diagnosis is most often made late in the course of the disease and often in the presence of a palpable upper abdominal tumor, at a time when, if we were concerned with carcinoma of the stomach, we would feel that there was no hope whatsoever for the patient. Some of these bulky exogastric sarcomata have been surgically excised with surprising ease.

Sarcomata of the stomach except for the spindle-cell variety are radiosensitive tumors. We have a very real adjunct in external irradiation, which, in the presence of an infiltrating sarcoma where surgery is out of the question, may afford definite palliation and possible cure (Case V).

Balfour, on the other hand, offers a more gloomy outlook for this tumor. After a survey of the fifty-four cases treated at the Mayo Clinc he concludes that neither the histological variety nor the presence or absence of metastases throws much light on the prognosis. The postoperative course of his patients for whom exploration alone was done averaged only four months. The postoperative length of life of his patients who had gastric resections and subsequently died was just eleven months. Of the living, there was only one patient who survived more than five years. Broders analyzed twelve cases of lymphosarcoma of the stomach and commented on the poor prognosis. Meischke stated that gastric sarcoma recurs much more rapidly than carcinoma of the same organ.

According to available case reports there have been at least seven patients who have lived six to fourteen years after gastric resection, *e.g.*, Broders, nine years; Weedon,[61] nine years; Kimpton,[41] six years; Frazier, fourteen years; Ruppert,[55] fourteen years; McWhorter, ten years. This last case history which we present with the permission of Doctor McWhorter is of a patient who is living and well ten years subsequent to a gastric resection for myosarcoma. One of our patients (Case V) has lived six years following radiation therapy. Another patient with primary lymphosarcoma of the stomach which was resected by Doctor Harvey is living and well seven years later. (Case VII.)

Treatment.—Surgery has relatively more to offer for sarcoma than for carcinoma of the stomach. Partial gastrectomy is the procedure of choice for operable tumors confined to the stomach. Except for the infiltrating lymphosarcomata there is often a sharp demarcation of these sarcomata from the normal stomach which greatly facilitates resection. The exogastric sarcomata (myosarcoma and neurosarcoma) which are next in frequency to the lymphosarcoma are usually found operable in spite of their large bulk. Cheever states that the radical operability in his cases was 22.3 per cent. Of Balfour's

fifty-three cases which came to operation, fifteen were inoperable and thirty-eight were operable, in which the operative mortality was 11.3 per cent. Exploratory laparotomy was done in several of our cases with no advantage other than establishment of the diagnosis by biopsy; the two patients (Cases II and VII) who had subtotal gastrectomies for myosarcoma and lymphosarcoma respectively are now living and well ten and seven years after the operations.

Radiation therapy is not of great value in the treatment of myosarcoma and neurosarcoma, but is always indicated for gastric lymphosarcoma. Lymphosarcomata in any location are radio-sensitive and the gastric tumors of this type are no exception. When the involvement of the stomach is only part of a generalized lymphosarcomatosis and is recognized if at all in the terminal stages of the diseases, very little palliation may be expected from radium or X-ray treatments. Beneficial even curative results may follow carefully planned radiation therapy of primary gastric lymphosarcoma. We have treated three patients with primary lymphosarcoma of the stomach; one is living almost six years after treatment (Case 5), another is in excellent health three years later and the third patient has just completed the first cycle of X-ray exposures. If the surgeon finds such a lymphosarcoma to be operable, he should not rest content with resection but should employ post-operative irradiation in addition. The possibility of tumor necrosis and hemorrhage has been borne in mind; fortunately we have not encountered this complication.

External sources of radiation are used, either high voltage roentgen rays or a four gram radium element pack. The radium is applied at a radium-skin distance of fifteen cm. with a filter the equivalent of one mm. of platinum and a dose of 100,000 mgm. hours per field. The roentgen-ray factors are: 200 kilovolts, 30 milliamperes, 70 centimeters target skin distance and a total dose of 2,400-3,000 roentgen units per field, delivering this in fractionated doses of 200-300 roentgens daily alternating between the ports. Three skin fields are mapped out, usually left anterior, left lateral and left posterior, their exact location being determined by marking the skin during fluoroscopic study of the stomach.

Case Reports

Case I.—G. I., a white man, aged twenty-eight years, experienced a sudden onset of cramplike abdominal pain, which persisted with increasing severity and nausea for one year. He entered the New York Hospital where at laparotomy a huge bluish, friable and pedunculated tumor was found arising from the anterior stomach wall. A subtotal gastrectomy was performed following which he suffered severe upper abdominal pain and occasional nausea. The tumor proved to be a highly malignant exogastric leiomyosarcoma, which invaded the entire thickness of the stomach wall, leaving the mucosa intact; numerous mitotic spindles were seen among the spindle cells.

The patient entered the Memorial Hospital four months later (June 26, 1922) at which time he was in poor condition. A large firm mass, twenty by thirty cm. in diameter, was palpated in the left upper abdominal quadrant. A roentgenogram showed extensive diffuse recurrence in the stomach. Eight low voltage X-ray treatments were given between June 29, 1922, and October 11, 1922, through anterior, posterior and lateral

ports with appreciable change in the size of the tumor. Death occurred on January 20, 1923, approximately two years after the onset of symptoms.

CASE II.—M. W., a white married woman, aged thirty-two years, was admitted to the French Hospital, December 10, 1923, on the service of Doctor McWhorter, through whose courtesy we have been privileged to report this case. She complained of lower abdominal pain and vaginal bleeding of one week's duration. Physical examination at this time revealed nothing but marked epigastric tenderness. At operation, a large ulcer on the anterior wall of the stomach was excised and repaired.

On March 6, 1924, she was readmitted to the French Hospital complaining of pain in the epigastrium and left hypochondrium, radiating to the back and left shoulder. The pain bore no relation to meals but vomiting occurred *post cibal*. The examination on readmission was negative except for anemia and a small immovable tumor the size of a hen's egg, located in the epigastrium. There was no free hydrochloric acid in the gastric contents. Roentgenograms of the stomach showed a rigid, indurated, concave lesion, two inches in diameter, situated on the lesser curvature. A second laparotomy was performed April 10, 1924. Gastric resection was done with the actual cautery, followed by posterior gastroenterostomy.

The floor of the ulcer showed a diffusely infiltrating round and spindle-cell tumor characteristic of myogenic sarcoma. There were numerous mitotic figures seen in each microscopic field (Fig. 2). A review of the slides prepared from the first excised ulcer showed a similar histologic process, except that it was almost entirely circumscribed.

This patient was discharged from the hospital after an uneventful convalescence and remained well until January 17, 1925, when she was operated on again for acute intestinal obstruction. No evidence of recurrence of the sarcoma was found and the gastroenterostomy was intact. Gastro-intestinal roentgenograms made at frequent intervals have not shown any recurrence. The last report (from Doctor McWhorter) on December 10, 1933, was that the patient was in excellent health, ten years post-operative.

CASE III.—T. H., a white man, aged fifty-two years, was admitted to the New Haven Hospital, September 21, 1924, on the service of Dr. Samuel C. Harvey. He complained of a severe pain developing in the chest and descending into the upper abdomen. He had experienced this pain for four months. The abdomen had become distended during the last three weeks. Physical examination of this emaciated patient revealed a marked ascites. Paracentesis abdominalis was done evacuating 3,000 cc. of cloudy straw-colored fluid. A large mass in the left upper abdomen, a smaller mass in the right upper abdomen and several small deep epigastric tumors could then be palpated. The liver function and blood count were normal. Roentenograms following a barium enema showed an apparent obstruction in the upper ascending colon. The preoperative diagnosis was intestinal cancer with peritoneal metastases.

An exploratory laparotomy was performed by Doctor Moise on October 1, 1924. A large flat, firm tumor was found involving the greater curvature of the stomach with metastasis to the perigastric lymph nodes. A biopsy was obtained. The tumor was composed of closely packed spindle cells many of which showed mitotic figures. The ascites recurred and required five additional paracenteses. The patient died on November 28, 1924. At the necropsy the tumor was found to involve the stomach, liver, peritoneum, pleura, appendix and iliac and retroperitoneal lymph nodes. The first microscopical diagnosis was lymphosarcoma, but a recent review of these specimens by Dr. Fred Stewart has led to a revision; it is unquestionably a myosarcoma.

CASE IV.—S. H., a mulatto male, aged fifty-four years, applied to the New Haven Hospital for treatment on March 3, 1925. He was admitted on the service of Dr. Samuel C. Harvey. He had complained for seven months of eructation of gas, loss of weight and a gradually enlarging mass in his left upper abdomen. He had experienced intense continuous pain in this region for five days prior to admission. Physical examination showed the tumor in the left hypochondrium to extend eight cm. to the right and eight cm. below the umbilicus. Its edge was smooth and notched, the pre-

sumptive diagnosis was Banti's disease. The liver function test and blood counts were normal. The Wassermann test was negative. Roentgenograms showed an elevation of the left diaphragm and apparent multiple discrete calcifications in the spleen.

On March 12, 1925, this tumor was resected by Doctor Harvey together with the spleen and a portion of the stomach. It was friable, nodular and cystic and originated from the greater curvature of the fundus. It was adherent to the diaphragm and spleen. The patient received two blood transfusions during the operation but died in shock eleven hours postoperative.

Gross examination of the tumor showed it to measure 32 by 20 by 10 cm. in diameter and to weigh 3,600 Gm. Its attachment to the stomach was only 4 by 5 cm. in size, and here a small ulcer was found in the mucous membrane. The tumor contained many necrotic cystic cavities. On microscopic section, the neoplasm was composed almost entirely of spindle-shaped cells growing in fascicular arrangement. The muscle layer of the stomach wall was invaded and replaced by these tumor cells. This very cellular myoma had sufficient infiltrative properties to be classified as an exogastric pedunculated myosarcoma of borderline malignancy.

CASE V.—A. E., a married white woman, aged forty-six years, applied to the Memorial Hospital for treatment on January 2, 1929. She first complained of dysphagia and epigastric pain in January, 1928. These symptoms increased in severity until May, 1928, at which time gastrointestinal roentgenograms showed a bulky tumor involving the cardia and pars media. The diagnosis was confirmed at operation; a biopsy was obtained from an inoperable tumor the size of a grapefruit. The tumor was composed of small hyperchromatic cells growing diffusely in a scant stroma with no tendency to form alveoli. Doctor Ewing and Doctor Stewart have been undecided whether histologically to classify this tumor as an anaplastic carcinoma or a lymphosarcoma, but have leaned toward the latter diagnosis.

Treatment was entirely by radiation therapy, high voltage X-rays being employed in San Francisco late in 1928 and treatment by the four gram radium element pack at the Memorial Hospital in January, 1929. With the radium pack, 48,000 mgm. hours were given at 15 cm. distance anteriorly and posteriorly to crossfire at the stomach. The patient improved rapidly, regained her appetite and good digestion and gained in weight. Repeated roentgenographic examinations have failed to reveal any filling defects or abnormalities in the stomach. The last verbal report in January, 1935, from the patient now residing in California was that she was not experiencing any gastric distress. This patient at least received six years of life and good health following the successful radiation treatment of her inoperable primary gastric sarcoma.

CASE VI.—J. M., a white man, aged fifty-eight years, applied to the Memorial Hospital for treatment on July 2, 1934. He complained of indigestion and epigastric discomfort of two years' duration. Roentgenograms of the stomach made in the summer of 1933 were negative, but he was treated for peptic ulcer by his family physician. The persistent gnawing pain continued in spite of ulcer treatment until April, 1934, by which time he had lost twenty-six pounds. On this date he was admitted to St. Luke's Hospital, New York, where an exploratory laparotomy was performed. The entire upper half of the stomach was involved by a very hard tumor mass which apparently completely encircled the wall of the stomach, although apparently not obstructing the lumen. The omentum was firmly adherent to the anterior gastric wall and contained many hard nodules, one of which was removed for a biopsy. It was diagnosed by Dr. Fred Stewart as a reticulum cell lymphosarcoma. He received three blood transfusions at St. Luke's Hospital.

Physical examination of the patient was essentially negative except for evident loss of weight and firmness in the epigastrium. No abdominal tumor could be palpated. There was no ascites and no enlargement of the superficial lymph nodes. Gastric analysis showed a content of free hydrochloric acid of forty-two degrees and a total acidity of seventy degrees. Gastrointestinal roentgenograms revealed a filling defect involving

the cardia, fundus and both curvatures of the proximal half of the stomach. The blood count was as follows: hemoglobin, 51 per cent., erythrocytes, 4,380,000; white blood cells, 11,600; small lymphocytes, 63 per cent.; polymorphonuclear leucocytes, 23 per cent.; myelocytes, 2 per cent.; miscellaneous white cells, 12 per cent. This patient, with a primary lymphosarcoma of the stomach, is now receiving fractionated doses of high voltage X-rays, a total of 3,000 roentgen units being given to each of the three ports, left anterior, left lateral and left posterior, all irradiation delivered within a month.

CASE VII.—A. G., a white man, aged fifty-three years, was admitted to the New Haven Hospital, March 8, 1926, on the service of Dr. Samuel C. Harvey. He complained of a sharp pain in his back, heartburn and vomiting of nine months' duration. The pain occurred two or three hours after meals. There was no blood in the stools or vomitus. The physical examination was essentially normal except for tenderness in the epigastrium. Gastro-intestinal roentgenograms showed a constant irregularity of the lesser curvature at the pylorus. An incisura is seen on the greater curvature opposite this defect. There was no six-hour gastric residue. The blood was normal. The pre-operative diagnosis was pre-pyloric carcinoma of the stomach.

Doctor Harvey resected this segment of the stomach on March 16 1926. Gross pathologic examination of the specimen showed two well-marked ulcer craters in the center of the indurated area. The ulcers were irregular, sharply punched out and had a smooth white base. On microscopic study of these ulcers, the mucosa nearby was atrophic secondary to an extensive round-cell proliferation within the submucosa. The cells were small and tightly packed infiltrating the muscular coat. The diagnosis of lymphosarcoma was confirmed by Dr. James Ewing. At the last examination (Nov. 7, 1933) seven and a half years later, this patient was alive and in good health.

CASE VIII.—E. C., a white married woman, aged sixty-five years, applied to the Memorial Hospital for treatment on May 31, 1932. She had complained for two months of hoarseness, dysphagia, the presence of a lump in her throat and the loss of thirty pounds in weight.

Examination shows the right tonsil to be greatly enlarged, soft, smooth and ulcerated. One right upper deep cervical lymph node was palpable. The liver was enlarged and its margin could be palpated three fingerbreadths below the costal margin. A large abdominal tumor transmitted pulsations from the aortic bifurcation. A roentgenogram of the chest showed mediastinal lymphoadenopathy, thickened left pleura, a mass in the left lung and pleural effusion. The biopsy report from the tonsil was either lymphosarcoma or lympho-epithelioma. The only treatment given was palliative external radium therapy to each side of the neck.

The patient was readmitted to the hospital for nursing care in August, 1932. At this time a large tumor could be felt in the left epigastrium and umbilical region. Death occurred on September 5, 1932. The postmortem examination confirmed the clinical diagnosis of generalized lymphosarcomatosis. The tumor was found to involve the axillary, femoral, cervical, mediastinal, mesenteric and lumbar lymph nodes, tonsil, left lung and stomach. The microscopical diagnosis was reticulum cell lymphosarcoma. The stomach was greatly enlarged with thickened walls and enormous rugae (Fig. 5). The rugae, subserosal, muscular and submucous coats were solidly infiltrated by lymphosarcoma (Fig. 6). The cardia contained a round, soft tumor which projected into the cavity of the stomach; this tumor measured 10 by 10 by 5 cm. Another tumor nodule measuring three cm. in diameter was situated on the anterior wall of the lesser curvature near the pylorus.

CASE IX.—J. J., a single white man age twenty-four years applied to the Memorial Hospital for treatment on August 17, 1932. In March, 1932, he first observed bilateral enlargement of his cervical lymph nodes. On July 22, 1932, his tonsils were removed at a nose and throat hospital. Immediately after this operation the cervical lymph nodes grew with great rapidity. Examination of this anemic emaciated patient revealed numerous spherical, discrete lymph nodes in both submaxillary, anterior cervical, axillary and

inguinal groups. There was a tender tumefaction in the region of the left hip. Roentgenograms showed an intertrochanteric fracture of the left femur and a destructive process in the right femur. The right upper abdominal quadrant contained a firm round mass, eight cm. in diameter and extending to the level of the umbilicus. A biopsy from an inguinal lymph node was reported as reticulum cell lymphosarcoma.

This patient was placed in the Heublein radiation bath at twenty-four feet from the source of the X-rays, receiving continuous irradiation under the care of Dr. Lloyd F. Craver until 41 per cent. of a skin erythema dose had been delivered to the entire body surface. Improvement occurred for a month, when the patient suddenly became moribund and died. The postmortem examination confirmed the clinical diagnosis of generalized lymphosarcomatosis. The tumor was found to involve the cervical, bronchial, retroperitoneal, mesenteric and inguinal nodes, spleen, kidneys, adrenals, small intestines, femora and stomach. The stomach contained three thin patches of lymphosarcoma, the smallest one cm. in diameter, the largest five cm. wide and causing deep ulceration, almost perforation of the gastric wall. There were scattered, ulcerated patches of lymphosarcoma in the ileum and lymphosarcomatous infiltration of the epiploic appendages.

Summary.—A report is given of nine sarcomata of the stomach, consisting of four myosarcomata, three primary gastric lymphosarcomata and two cases of generalized lymphosarcomatosis with secondary involvement of the stomach. Sarcomata comprise 1 per cent. of all gastric tumors. The sexes are equally involved. The average age of the patients is forty-six years. Gastric sarcomata are classified according to symptomatology, histology, location and the direction of growth. These factors are all interwoven and on them depend the treatment and prognosis. Some of the tumors are symptomless. The greater number present an upper abdominal tumor without definite gastric distress. Obstructive symptoms are infrequent. Pain occurs only in the presence of ulceration of the mucosa. The average duration of symptoms is nine and a half months. Sarcomata of the stomach are difficult to distinguish from carcinomata by roentgen-ray studies, although horizontal filling defects and the persistence of gastric peristalsis in the presence of a definite lesion are suggestive. Partial gastrectomy is the procedure of choice for the localized tumors and is especially successful in the case of the exogastric sarcomata. The gastric lymphosarcomata are extremely radiosensitive and respond favorably to carefully planned radiation therapy.

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PRIMARY PERFORATED JEJUNAL ULCER

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Single primary jejunal ulcers are rare clinical entities. They are seldom diagnosed until perforation or obstruction has made operation imperative, or they are discovered at autopsy. In a few of the reported cases the perforated ulcer, being unsuspected, was not discovered at operation.

In a personal communication from Dr. Douglas Symmers,[1] Director of Laboratories, Pathology Department, Bellevue Hospital, New York City, he states: "Among 17,518 autopsies, seventeen instances of jejunal ulcers were encountered. In five, the ulcer was limited to the jejunum; in the remaining twelve they were associated with other ulcerative lesions in the gastro-intestinal tract. Of the seventeen cases, twelve were tuberculous; two were nontuberculous and of other wise unknown origin. One was associated with chronic mitral valvulitis with a few apparent vegetations and an extensive thrombophlebitis of one of the lower extremities. In the latter case a lesion in the jejunum was regarded at autopsy as of probably embolic origin. Microscopical examination failed to substantiate this view. In still another instance there was a large adeno-carcinoma in the cecal region and a small ulcerative adeno-carcinoma of the jejunum. In view of the comparative frequency of carcinoma of the cæcum and the extreme rarity of carcinoma of the jejunum, the ulcer was regarded as a metastatic deposit from the growth in the cæcum. Finally, in still another case an ulcer of the jejunum was associated with leukæmia.

"Among approximately 48,500 examples of surgical material received in the laboratory from the operation rooms there were no ulcers of the jejunum. In only two of the seventeen cases was perforation encountered; one ulcer was tuberculous; the other occurred in a thirty-five-year-old woman, whose case I have outlined above with the mitral lesion, *etc.* It would seem, therefore, that not only is an ulcer of the jejunum an exceedingly rare event, but that perforation is a pathological curiosity."

No acute perforated primary jejunum ulcers are reported in the pathological department at the Bellevue Hospital.

Dr. William C. MacCarty,[2] Department of Pathology of the Mayo Clinic, in a personal communication states that, "He does not know of a case of primary perforated ulcer of the jejunum, during the twenty-five years that he has been at The Mayo Clinic. Had there been one there he felt sure it would had been reported."

As regards experimental production of jejunum ulcers, Dr. F. C. Mann,[3] of The Mayo Clinic, in a personal communication states, "In regard to our experimentally produced ulcers we have found that we can produce an ulcera-

tion in the jejunum a foot or so away from the stomach by making an acute angulation of the loop of the gut. The ulcer develops at the bend of the loop of intestine. However, in your case it would appear that the ulcer was too far away from the stomach to have the same causative factors as occurred in our experimental peptic ulcer. I cannot imagine the cause for the development of jejunal ulcer in your case."

Dr. I. M. Gage,[4] of the Department of Surgery, Tulane University of New Orleans, reports: "That in his thirteen years' connection with the Charity Hospital there, he does not recall having heard of this condition occurring in the Institution."

A review of the literature since 1827 reveals twenty-five cases of single primary jejunal ulcers unassociated with ulceration in any other part of the gastro-intestinal tract. The author, herewith, reports the twenty-sixth case. For case reports of multiple jejunal ulcers or jejunal ulcers associated with ulceration elsewhere in the gastro-intestinal tract, the reader is referred to the excellent essay by Ebeling.[5]

CASE REPORT.—(Unit No. 81184.) Patient, T. M., white male, aged twenty-seven, was first admitted to the out-patient department of Presbyterian Hospital, April 8, 1925, complaining of pains in his joints of six months' duration.

Temperature, 98.4°; pulse, 100; respiration, 24. Weight, 165 pounds. The relevant facts of his history and physical examination, at that time, were as follows:

He appeared a well-nourished and normally developed young man, with a flushed face. He had always been "strong and healthy" except for measles and whooping cough in childhood, occasional attacks of "grippe" and sore throat and slight head colds. He denied other illnesses. He smoked twenty to thirty cigarettes a day.

For six months before admission he had irregularly noted pains, stiffness and occasional slight swelling in the following regions; both heels, ankles, knees, elbows and wrists. The pains appeared in different joints at different times without regularity. He had never had temperature to his knowledge when his joints ached.

Many of his teeth were crowned. There was no evident caries or gingivitis. His tonsils were large, cryptic but not acute. His pharynx was congested. Blood-pressure, 140/100. Examination of the abdomen, negative. His diagnosis was subacute multiple arthritis. Tonsillectomy was done April 24, 1925.

May 14, 1925, he reported that his joint pains were a great deal better and had almost entirely disappeared. He now reported that he had noted for the past two months pain in the calves of both legs when walking. This he failed to report previously because he associated the pain with that in his joints. His joints, however, had improved, but this pain continued.

From May 14, 1925, to October 25, 1928, patient was lost track of. At this later date he returned for observation and was admitted to the Presbyterian Hospital. In this interim, three years, 1925–1928, the following had occurred: he had presented himself at the Polyclinic Hospital, New York City, in September, 1925, and had there been diagnosed as a case of thrombo-angiitis obliterans. Dr. K. Winfield Ney, of the Polyclinic Hospital, kindly furnished me with the following facts concerning his treatment there. His complaint was a cold painful right foot. Examination revealed absent pulsation in the posterior tibial and dorsalis pedis arteries of both feet. Both lower extremities rapidly blanched when elevated above the level of his recumbent body and became blue in three minutes when dependent. The right foot showed beginning gangrene in several toes.

Under local novocaine anæsthesia Dr. Winfield Ney, in September, 1925, performed a right common femoral peri-arterial sympathectomy which was immediately followed by improvement. The leg became considerably warmer down to the ankle. The foot, however, remained cold. Amputation was subsequently done a week later through the lower third of the thigh by Doctor Ozlin of the Polyclinic.

September 24, 1928 patient again applied for treatment at the Polyclinic Hospital complaining of marked intermittent claudication in the remaining left leg. His right amputation stump was comfortable and he used his artificial leg very well. He could walk only three blocks before pain in his left leg stopped him. He would rest for three or four minutes and then proceed again. The dorsalis pedis and posterior tibial were not palpable; faint pulsation was present in the left popliteal, but this was doubtful. Under novocaine anæsthesia a peri-arterial sympathectomy was performed on the left common femoral artery. Upon exposure of this vessel there was only a faint pulsation seen and the vessel appeared very small. Six hours after this operation the leg was very warm and red. A very good pulsation could then be felt in the popliteal artery. The dorsalis pedis and posterior tibial arteries still were not palpable. He experienced considerable relief of pain.

In October, 1928, four weeks later, he reported that his left foot was comfortable and practically free from pain. Slight pulsations were felt in both the dorsalis pedis and posterior tibial arteries. Elevation of the foot no longer produced a waxy pallor or the coldness formerly observed, although the circulation was not normal. He did not return to Polyclinic for further observation.

October 25, 1928, he returned to Presbyterian Hospital to the out-patient department and was admitted to the hospital. He complained of pain in his left leg and great toe. Two months previous to admission he was able to walk as far as he pleased without discomfort. During the past two months his pain gradually increased in his calf so he could not walk more than three or four blocks without resting and elevating his leg for two or three minutes.

Diathermy and whirlpool baths did not relieve his pain over a period of two months.

His physical examination was essentially the same as in 1925 except for an amputation through right lower thigh and absent pulsation in the left popliteal artery. The right thigh amputation stump was symptomless and he was using his artificial leg very well. The scar in the left upper femoral region at the site of the peri-arterial sympathectomy had given him no trouble. He now had a paronychium of his left great toe. The entire great toe was painful, red and swollen. No palpable temperature change was noted in the leg, foot or toes. With the foot dependent there was cyanosis of his great, fourth and fifth toes.

He now complained of "stomach trouble" which he had not done previously. This history is as follows:

In 1926, he first noted epigastric pain, a sour stomach and he occasionally vomited. The vomitus at no time contained blood. His local doctor prescribed a milk diet for ten days for his pain, which somewhat, but not entirely, relieved him. His pain was made so much worse by eating that he almost starved himself for relief. Pain was epigastric and non-radiating.

Frequently, during 1927 and 1928, shortly after eating, he vomited the food eaten. This occurred about twice a week. For his distress he would take soda induce vomiting and be relieved. His vomitus was sour and greenish. Epigastric fullness was most marked about 7 P.M.; it was not so during the day. He noted almost continuous epigastric tenderness. He drank a quart of acidophilous milk a day with some temporary relief. He was more comfortable when he did not eat. Red blood-cells, 4,700,000; white blood-cells, 11,000; hæmoglobin, 95 per cent.; polymorphonuclears, 67 per cent.

Stool with guaiac April 14 and 16, 1929, positive. Stools, brown. Rectal examination, negative. Urine, negative.

Ewald test meal—two slices of bread—200 c.c. water

	4/9/29		4/23/29	
	Free	Total	Free	Total
Gastric expression before meal.....	0	13	0	14
One-half hour after meal.....	0	16	29	40
One hour after meal.....	5	20	35	52
Two hours after meal.....	23	44	25	38
	Guaiac negative		Guaiac negative	

X-ray of left foot and leg negative for calcification of arteries.

Gastro-intestinal X-ray April 15, 1929, showed a normal œsophagus, stomach and duodenum. During fluoroscopy tenderness was noted over the right upper quadrant but not over the gastric area.

X-ray of gall-bladder, November 19, 1929, after the oral ingestion of four grams of tetraiodophenolphthalein showed the gall-bladder outlined very distinctly. Shrinkage was noted after a fat meal and the gall-bladder was regarded as normal.

A second gastro-intestinal X-ray study, April 25, 1929, showed a normal duodenum, except for an occasional short period of spasticity, but no deformity suggesting an organic lesion. There was no six-hour gastric residue. This examination was reported as negative. Wassermann, negative.

April 26, 1929, an E. K. showed sinus rhythm. Ventricular rate 70 P-R—0.14. Right preponderance. P upright in all leads. T upright in all leads. Right preponderance is marked, suggesting right-sided hypertrophy of the heart, or a so-called vertical heart.

April 24, 1929, he was started on intravenous protein injections of 50,000,000 typhoid vaccine organisms in twenty cubic centimetres of normal saline.

He was in the hospital for one month and with local treatment of his foot and continued rest, his paronychium healed, but the gastric symptoms during his stay were always present and he was regarded by those who saw him as having a pyloric or duodenal ulcer in spite of negative X-rays. He was kept on an ulcer diet, but was never completely symptom-free.

May 22, 1929, patient reported that the pain in his ankle and cramps in his calf appeared on walking after one block. He had been faithfully taking his foot soaks, and following his régime of elevation depression exercises.

At follow-up, July, 1929, two months after discharge, he reported he could walk two blocks, after which he got cramps in his calf which forced him to sit down. With his leg dependent, the great toe, lateral side of fifth and lateral dorsal surface of the fourth toe became a deep red color. The fourth and fifth toes blanched immediately upon elevation of 60°. He ate all except fried food without discomfort and did not take any medicine for his stomach. His gastro-intestinal tract at this time was symptomless.

From October, 1928, until June, 1929, the patient had eighteen injections of typhoid vaccine; beginning with 50 million and increasing to 150 million, with which dose he had his first chill and his mouth temperature rose to 101.5° F. With these treatments the pain in his left foot and leg decreased but he still could not walk more than three or four blocks without having to rest.

During his visits to the clinic for protein injections he had never complained of his gastro-intestinal tract. He lost twenty-nine pounds in eight months.

July 26, 1929, patient was readmitted to Presbyterian Hospital at noon acutely ill with severe abdominal pain of seventeen hours' duration. Five o'clock the day before this admission patient experienced a sharp sudden pain in his upper abdomen, particularly in his left upper quadrant, radiating downward into his left lower quadrant. It became progressively worse. He vomited shortly after its onset and continued to

do so each time he took fluid by mouth. Pain lasted the entire night, keeping him awake, yet the patient was not greatly concerned, for during the past two years he had various degrees of pain in his upper abdomen which had heretofore subsided. His pain, however, had never previously been as severe as it was now.

Temperature, 99°; pulse, 100, respiration, 18. He groaned and writhed in great pain. Clammy perspiration was on his forehead. Examination was essentially negative except for his abdomen. He showed diminished liver dullness but some liver dullness was definitely present. The abdomen presented board-like rigidity with hyperæsthesia of the skin over the left half and an area of maximum tenderness about three centimetres lateral and two centimetres below and to the left of the umbilicus. He was diagnosed perforated duodenal ulcer.

White blood-cells, 20,000; polymorphonuclears, 88 per cent. Operation was done eighteen hours after onset of acute symptoms. Under gas-oxygen anæsthesia, a small right transverse subcostal incision lateral to the right rectus muscle was made giving a splendid exposure of the pylorus and duodenum which were found normal. The hand was introduced through this wound and the appendix was felt to be normal. No exudate was seen, but upon withdrawing the hand the glove was found to contain a thin, non-odorous sticky exudate. A second incision three inches long was then made in the mid-line below the umbilicus where a small amount of similar exudate was noted among coils of small intestine. After finding the appendix and lower twenty-four inches of ileum normal, the small intestine was searched upward until a perforation about two by two millimetres across with slightly slightly out-pouting indurated mucosa was found on the antimesenteric border of the jejunum two feet below the ligament of Treitze. The loop of jejunum containing the perforation had become adherent by early fibrinous adhesions to adjacent loops partially sealing off the perforation. There was only a small areola of induration about two millimetres across about the perforation. No foreign body could be found. There was no demonstrable pathology in the vessels of the mesentery or gut wall throughout the small and large intestine. No specimen was taken of the ulcer or gut wall. Two layers of Lembert sutures of zero plain catgut were placed in the longitudinal axis of the jejunum to close the perforated ulcer. Both abdominal wall wounds were closed in layers with chromic catgut. Small rubber dam drains were placed down to the peritoneum in each wound. Peritoneal fluid obtained at operation failed to grow organisms in blood agar and meat broth.

First day post-operative temperature rose to 103° F. The third day was normal and remained so. Drains were removed on the second day and the wounds healed by primary union. By the seventh post-operative day the patient was convalescing rapidly and was free of the pain that he previously had for two years. He was discharged on the fourteenth day, with both wounds healed and symptomless. He had been on a regular ward diet for five days before discharge.

October 2, 1929, three months' follow-up: He had gained twenty pounds. Pre-operative epigastric pain had completely disappeared. Ate all foods without discomfort. Cannot walk more than two blocks before pain in his calf causes him to rest.

April 9, 1920, nine months' follow-up: No abdominal symptoms. Eats everything without discomfort. Can still walk only three blocks, but notices cold less and has had less pain. With foot dependent there is less cyanosis.

June 25, 1920, eleven months' follow-up: Can walk three or four blocks. Has had a migrating phlebitis in the medial ankle region. His gastro-intestinal tract is symptomless. Has been getting weekly intravenous doses of 50,000,000–75,000,000 typhoid vaccine for ten doses.

January 7, 1931, eighteen months' follow-up: Gastro-intestinal tract symptomless. Thinks he is having less pain in his leg. It does not wake him up at night. He can walk five or six blocks without stopping. Surface temperatures in left leg as follows: (Tycos Dermatherm.) Normal temperature, 31°–32° C.

November 4, 1931:

Great toe	25.4° C.
Fifth toe	26.2
Dorsum	28.4
Heel	28.5
Lower 1/3 leg	29.8
Middle 1/3 leg	30.0
Upper 1/3 leg	30.1
Lower 1/3 thigh	30.3

November 4, 1931, two and one-half years' follow-up: Abdomen symptomless. Eats everything without discomfort. Can still walk only three or four blocks before intermittent claudication pain stops him.

December 7, 1932, three and one-half years' follow-up: Has gained forty-four pounds since discharge. Present weight, 166 pounds.

No symptoms referable to his gastro-intestinal tract. Wounds firm and symptomless. To continue with small doses of intravenous typhoid vaccine protein.

December 11, 1932, following intravenous injection of 10,000,000 typhoid organisms, the patient's temperature rose from 34° to 38° C. and the surface temperatures of his left foot rose from 30.5° to 36.5° C.

December 18, 1932, there was no surface temperature rise in his foot accompanying the anæsthesia obtained by infiltrating ten cubic centimetres of one per cent. novocaine about his posterior tibial nerve at the internal maleolus. This was conclusive proof of organic rather than spastic vascular occlusion.

April 15, 1933, four years' follow-up: No gastro-intestinal-tract symptoms. Weight, 168 pounds. Can only walk four blocks, otherwise he feels entirely well.

March 7, 1934, five years' follow-up: Symptomless as regards gastro-intestinal tract. Still walks only four or five blocks before intermittent claudication in his calf muscles stops him. Has no symptoms of thrombo-angiitis obliterans elsewhere.

A review of the literature has brought out interesting points regarding terminology, symptoms, pathology and treatment. It has thrown no light on the etiology of this lesion, which remains even more obscure than that of duodenal or gastric ulcer.

Terminology.—A confusion of terms exists in the literature which has made a review unnecessarily tedious. Cases recorded as jejunal ulcer are not specified as primary or secondary to an operative procedure upon the stomach, duodenum or jejunum. The term peptic ulcer is used for both primary jejunal ulcers and those following gastrojejunostomy. The author would suggest the term "Primary Jejunal Ulcer" to mean an ulceration of the jejunum where there had not been a preceding operative procedure on either the stomach, duodenum or jejunum, and the term "Secondary Jejunal Ulcer" to denote an ulcer in the jejunum following some operative procedure on the stomach, duodenum or jejunum—and the nature of the preceding operation should be recorded. With the etiology of the primary and secondary jejunal ulcers still unknown, it avoids possible confusion to consider them as distinct and different clinical entities. If multiple ulcerations exist in the jejunum or if a jejunal ulcer is accompanied by an ulceration in some other portion of the gastro-intestinal tract, it should be so stated in the title of the report.

Etiology.—This remains unknown and the author has no adequate explanation to add. Etiological factors encountered in the literature must be

accepted only for their theoretical value. The ones most frequently encountered are listed below:

(1) The result of peptic digestion.
(2) The result of tryptic digestion.
(3) Following trauma.

Most cases associated with trauma have from their histories apparently had the ulcer present before the trauma occurred and trauma only served to rupture the ulcer. The association of rupture of an existing ulcer by trauma seems clinically and firmly established.

(4) Localized ischæmia of the vessel wall from thrombosis, emboli or disease of the mesenteric blood-vessels.
(5) Syphilis.
(6) Uræmia.
(7) Tuberculosis.
(8) Sepsis.
(9) Disease of the sympathetic nervous system.
(10) The presence of heterotopic tissue.
(11) Ulceration incident to focal infections of streptococci, staphylococci and pneumococci.

Symptomatology.—Many of the recorded cases give very incomplete reports of the ante-operative symptoms, signs and laboratory findings. In fact, a few of the case reports are so vague that they are worthless. The operative and post-mortem records have frequently failed to specify the exact site of the ulcer, which has made it difficult to determine whether it was duodenal, jejunal or ileal. The size of ulcers has been described corresponding to that of various coins of nations as well as seeds of fruits and plants.

No typical group of symptoms such as associated with gastric or duodenal ulcer has been encountered. The primary ulcer is such a rarity that only one author has reported more than one personal case. Morrin,[6] of Dublin, has seen and reported three personal cases. The symptoms such as recorded have led observers to the diagnosis of gastric or duodenal ulcers perforated or obstructing or peritonitis from a ruptured appendix or some unstated hollow viscus.

The author has found in the literature quite a common group of symptoms in the proven cases. These are listed below and when encountered should make one suspect the presence of a primary jejunal ulcer.

Pain.—The most frequent description encountered is as follows: Localized in the epigastrium, the left upper quadrant, or just above and to the left of the umbilicus; usually made worse by eating; non-radiating; appearing at no appointed time as regards meals and of a dull, boring character. Several of the cases have had such severe pain after eating they have voluntarily starved themselves. In no case was the pain completely relieved by the taking of food or an alkali powder. Patients would be free of pain for intervals of two or three months at a time. Varied diets did not relieve pain

nor did any particular type of foods precipitate it. It was not of a peristaltic type. The radiation of the pain associated with perforation in the left lower abdomen has been a rather constant finding in the proven perforated cases. Skin hyperæsthesia over the rigid muscles of this area was particularly evident in one case. The remaining signs of peritonitis are no different from those of peritonitis from any other perforated viscus.

Nausea occurred irregularly and vomiting very rarely. The latter was usually induced when it did occur and brought up food eaten within the previous two hours or if the stomach was empty it was rarely bile-stained unless there were concomitant signs of obstruction. Distention, "heart burn," gaseous eructations were not prominent symptoms but they were often incorporated in the symptom group called "indigestion" and were sufficiently prominent to make one suspect and rule out chronic biliary-tract disease in these cases. Peristalsis except in the obstructed cases did not seem clinically interfered with. Constipation was not a prominent associated symptom. The stools in all suspected cases should be searched for occult blood. Only one case showed clinical evidence of active gross bleeding. The gastric analyses in the few cases reported have shown a low rather than a high acidity. They have been of no diagnostic import.

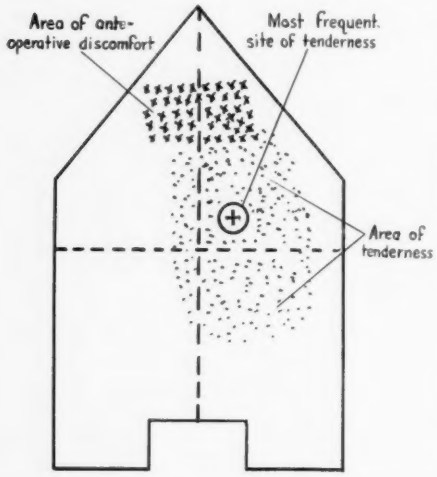

FIG. 1.

There were no prominent signs noted except occasional, indefinite tenderness elicited with difficulty, more often localized to the left of the mid-line in the lower half of the left upper quadrant nearer the mid-line than laterally.

Pathology.—The jejunum anatomically constitutes the upper two-fifths of the small intestine—that is, about eight feet. The succeeding three-fifths which usually measure about twelve feet constitute the ileum. The one portion passes insensibly into the other. The characteristic differences between the upper jejunum and lower ileum may be stated as follows:

The jejunum is wider being 1¼ to 1½ inches in diameter, whereas the ileum is only 1¼ to 1 inch across. The jejunal wall is heavier, thicker, redder, more vascular, the plicæ circulares are better developed and more evident, lymphatic nodules in the wall are few and small as compared to the larger Peyer's patches in the ileum. The vessels of the jejunal mesentery are larger, shorter, and more direct to the gut. The ileal mesenteric vessels are smaller and arranged in anastomosing secondary and tertiary loops.

Unless an ulcer has been described within ten feet of the duodeno-

jejunal junction, it has not been considered jejunal. Lesions located "in the middle of the small intestine" have been considered ileal.

The ulcers have grossly and microscopically shown acute and chronic inflammatory changes. There has been no exact pathological picture except of inflammation and ulceration. Tuberculosis, syphilis, arterial wall pathology have not been described. The pathological diagnosis has invariably been ulcer or simple ulcer.

The size of the ulcerated area has varied considerably from two millimetres to two centimetres wide and encircling the gut depending upon the age and chronicity of the process. More often the size of the perforation rather than that of the surrounding induration or the ulcer itself has been described. The author would like to plead for the recording of sizes and dimensions in measurements of the metric system rather than indiscrimate comparisons to likenesses of locally known objects and legends of inconstant sizes.

The majority of acute ulcers seem to occur on the antimesenteric border. This has been the site of most of the perforations. A few ulcers and perforations have been recorded at or near the mesenteric attachment. It would seem from case descriptions that ulcers beginning near the mesentery more often become the non-perforating chronic encircling constricting type of lesion—as shown by the older part of the ulcer microscopically being near the mesentery. This statement, however, cannot be proven.

The most logical explanation of the majority of ulcers occurring on the antimesenteric border lies probably in the arrangement of the blood supply of this region. This condition bears considerable similarity to the occurrence of perforation in strangulated obstructed gut. The arterioles in the wall of the small gut are regarded as terminal vessels in as much as they anastomose through exceedingly minute communications with vessels from the opposite side of the gut. The inability to provide sufficient blood supply at this point when threatened by whatever etiological factor encountered is dependent upon the minuteness of the vessels at that point.

The chronic ulcers cicatrize and occlude the gut. They encircle the gut partially or completely. They adhere to surrounding structures, stomach, colon, omentum, jejunum, duodenum, or parietal peritoneum. They have perforated into the adhesions where abscesses have formed which in turn have ruptured into the peritoneal cavity. Foreign bodies have been found free in the peritoneal cavity in cases of mid-intestinal ulceration, and also in the ileum of patients with jejunal perforations, but no direct association has been found between foreign bodies and single jejunal ulcers, although the possibility of such must be borne in mind. Single and multiple ulcers in the stomach, duodenum, ileum and colon have been described. Some of the multiple ulcerations have been associated with systemic diseases such as leukæmia, uræmia, carcinoma with metastases and foreign bodies in the intestines, but these have a recognizable pathological etiology and are not included in this review.

The course and treatment of this group of ulcers have been interesting. All of the cases have been diagnosed either by operation for perforation or obstruction or else at autopsy with the exception of three cases; one, a case reported by J. Kretschmer[6] in 1920, in whom a barium meal showed an obstruction in the "upper small intestinal loops"; a second reported by Ebeling[5] which was an obstructing ulcer six inches below the duodeno-jejunal juncture diagnosed by a barium X-ray meal study before operation; the third a case of Ravdin's,[7] also a constricting ulcer in the upper jejunum diagnosed by a barium X-ray study of this region.

The acute ulcers have been treated of late as duodenal or gastric ulcers with various combinations of multiple feedings of soft cooked foods, milk and cream mixtures and alkali powders, but we have as yet no recorded case of a proven healed jejunal ulcer that has not been operated upon. Those cases which have shown signs of early obstruction have all gone on to complete occlusion, necessitating surgery. No case is recorded of primary malignancy occurring at the site of either an acute or chronic simple jejunal ulceration. Jejunal ulcers treated ante-operatively have been so treated without their true pathology being suspected but on the basis of the treatment being directed towards a duodenal ulcer. X-ray has not been intentionally used to show a suspected jejunal ulcer. Were a non-stenosing jejunal ulcer to be demonstrated by X-ray it would be a matter of individual decision as to advisability of so-called medical treatment or surgical excision, as the ulcers are usually very accessible surgically.

The surgical treatment resolves itself in the acute perforation to resection of the ulcer, usually closing the site of excision opposite to the long axis of the excision, so as not to constrict the gut, closure of perforation with Lembert or purse-string catgut sutures, biopsy of ulcer or ulcer edge with closure, resection of a segment of jejunum with end-to-end or lateral anastomosis or rarely excision of ulcer and entero-enterostomy about the ulcer site provided it cannot be freed from surrounding structures. In cases of perforation, peritoneal toilet, drainage, enterostomy must be considered as the pathology warrants. The post-operative treatment of the concomitant peritonitis does not vary from that accompanying perforated gastric or duodenal ulcers. In most of the cases diagnosed as perforated appendices the incision had to be either enlarged or supplemented by a second one. Either an upper left or right upper rectus retracted incision should suffice if the diagnosis were known. In the presence of a peritonitis with no perforation demonstrable in the more common sites of perforated viscus—that is, stomach, duodenum, appendix, ileum, Meckel's diverticulum—the jejunum should of necessity be completely explored up to the duodeno-jejunal ligament.

The character of the peritoneal exudate is not distinctive. The presence of gas beneath the diaphragm, absence or diminution of liver dullness will only indicate the presence of free air in the peritoneal cavity but will in no way establish the source of the air. In the reported case it was strikingly noted that the abdominal pain at the time of perforation traveled from the

left upper quadrant down into the left lower quadrant and left lumbar gutter and that besides rigidity and tenderness over these regions there was also present marked skin hyperæsthesia. Should the author encounter these signs again he would certainly consider the pre-operative diagnosis of a perforation of the jejunum.

The author urges in cases of clinically suspicious gastric or duodenal ulcers which are not demonstrable by X-ray and in which biliary-tract disease has been ruled out that possible ulceration of the jejunum be suspected and the X-ray be ultilized to study by fluoroscope and film this portion of the small intestine.

The patient herewith reported is a known thrombo-angiitis obliterans case. This was recognized at the time of operation and a careful search was made through the mesenteric vessels for evidence of this pathology there but none could be found. There was no discernible evidence of there having been a thrombosis of the vessels in the jejunal wall along either the mesenteric or antimesteric border. This disease has been found in mesenteric vessels producing thrombosis and gangrene. Taube[8] reports the resection of eighteen inches of gangrenous intestine for mesenteric thrombosis in a clinical case of thrombo angiitis obliterans but no pathological reports are given. He also reports a case with clinical thrombo-angiitis obliterans, both of whose legs had been amputated for this disease whom he followed through four attacks of epigastric pain and vomiting which was relieved each time by two ampules of atropine 1/150 gr. (0.4 milligram). No operation was performed and the diagnosis of mesenteric thrombo-angiitis obliterans is entirely a clinical one.

Meyer[9] reports a case, both of whose legs had been amputated for thrombo-angiitis obliterans, who was operated upon because of abdominal pain, distention and occasional vomiting of ten weeks' duration. At exploration the following was noted: "The transverse and ascending colon and all the loops of the small bowel were greatly distended. No collapsed loop of bowel, obstruction, or organic lesion was found. The walls of the entire bowel were greatly hypertrophied. The mesenteric vessels were sclerotic and no pulsation was obtained. The patient died forty-eight hours post-operative. No necropsy was obtained." Again the pathological diagnosis of mesenteric thrombo-angiitis obliterans was not established.

Buerger[10] reports a case in which two days after amputation of the left thigh for thrombo-angiitis obliterans the patient developed intense abdominal pain and rigidity. A diagnosis of mesenteric thrombosis was made and at operation a gangrenous intestine was found due to mesenteric occlusion. Microscopical examination of superior mesenteric, common iliac, external iliac, abdominal and thoracic aorta showed the typical lesions of arterio-sclerosis. The microscopical picture of thrombo-angiitis obliterans was not present.

In a case of microscopically proven thrombo-angiitis obliterans of the extremity, vessels in which gangrene of some other portion of the body

occurs—that process is not necessarily thrombo-angiitis obliterans and should not be so designated without microscopical confirmation. The literature records many cases of proven extremity thrombo-angiitis obliterans who have succumbed to vascular lesions elsewhere which have shown microscopically to be thrombosis or arteriosclerosis without the typical thrombo-angiitis obliteran changes.

In the author's case it is entirely improbable that the primary jejunal ulcer was associated with thrombo-angiitis obliterans because, first, there was no visible or palpable evidence of the disease at operation, secondly, the patient has been absolutely and continuously free of abdominal and gastro-intestinal symptoms for five years after operation. He has gained and maintained the gain of forty-eight pounds in weight and the symptoms which he had referable to his abdomen for two years before operation have not been experienced in any degree since.

Total number of cases of primary jejunal ulcers, male, 17; female, 9; total, 26			
Total number of cases operated	19		
Total number of cases not operated	7 or 26.9%		
Total number of cases not operated, died	7 or 100%		
Total number of cases operated, died	9	operative mortality	47.4%
Total number of cases operated, recovered	10	operative recovery	52.6%
Total number of cases died, operation or no operation	16	total mortality	61.5%
Total number recovered of entire group	10 or		38.4%

Schmilinski, in 1910, records the first obstructed jejunal ulcer diagnosed at operation and successfully resected.

Number of cases diagnosed before operation unobstructed, unperforated	0
Number of cases diagnosed at operation unobstructed, unperforated	2
Number of cases diagnosed before operation obstructed, unperforated	3

X-ray established an otherwise unsuspected diagnosis in these cases.

Number of cases diagnosed at operation perforated	8
Number of cases diagnosed at operation obstructed	4
Number of cases not diagnosed at operation	2
Number of cases not operated, diagnosed at autopsy including two missed at operation	9
	23

Chronic Ulcers

Total number of chronic ulcers—19
Total number operated—14
Total number ulcers resected with gut—8
Total number died resected with gut—2 or 25%
Total number recovered resected with gut—6 or 75%
Ulcers closed by suture without resection—3—recovered, enterostomy done in one of these cases
Ulcers closed with omentum—1—died
Ulcers not resected—duodenojejunostomy—1—recovered
Missed at operation—perforated—1—died

Obstructed—not perforated	4
Obstructed—perforated	2

Not obstructed—not perforated 2
Not obstructed—perforated 2

10

Chronic ulcers perforated—associated with trauma—3, 3 died, diagnosed by autopsy
Of the 8 resected segments of jejunum, 3 were anastomosed by lateral anastomosis

Obstructed and perforated chronic ulcers 2
Perforated—not obstructed 10
Obstructed—not perforated 5
Not obstructed—not perforated 2

19

Undetermined from reports acute or chronic—3
3 perforated—all 3 died
2 were operated upon—both died
1 not operated—died. Diagnosed by autopsy

Acute Ulcers

Total number of acute ulcers—4
Total number operated upon—3

Resected ulcer with gut—recovered 1
Sutured not resected—died 1
Missed at operation (perforated) died 1
Not operated—diagnosed at autopsy 1

4

CASE REPORTS FROM THE LITERATURE 1827–1933, INCL.

CASE I.—(Cited by Richardson.[11]) (Wagner, E.: Arch. f. Physiol. Heilkunde, vol. 2, p. 280, 1858.) A laborer of eighteen was buried up to the lower chest by a fall of earth. He gave evidence of peritonitis and died twenty-two hours later. Autopsy showed diffuse peritonitis. The mucosa of the stomach and duodenum was normal. After freeing omental adhesions on the surface of the jejunum, opposite the mesentery, six inches from the end of the duodenum, an oval hole was found, from which intestinal contents flowed. The adjacent mucosa showed normal microscopical structures. The remaining intestine showed no ulceration. A reconstruction of the anatomical changes is most probably as follows: A chronic ulcer of the upper jejunum gradually consuming all layers was hindered, at least temporarily, from perforation by adhesions of the omentum. As a result of burying, the omental adhesions were separated. The jejunal ulcer had the greatest similarity with the so-called perforating or simple chronic ulcer of the stomach, and is to the same, at all events, analogous.

CASE II.—(Cited by Richardson.[11]) (Taylor, A. S.: Guy's Hospital Reports, vol. 11, p. 282, 1865.) It is well known as a principle in medical jurisprudence that death may apparently take place as the result of violence, when a careful post-mortem examination of the dead body may show that this was a mere coincidence, and that the person really died from disease. All cases of this description convey the warning that no medical opinion of the cause of death should be given until after a post-mortem examination of the body has been made. The following case was communicated to me by Mr. Morgan, of Merthyr Tydvil, in whose practice it occurred.

In July, 1864, a man named David Lloyd died under the following circumstances. The deceased was of middle stature, aged forty-five, and much given to drinking. He formed one of a number of persons who were helping a farmer during the hay harvest;

and, as is usual on these occasions, there was a good supply of beer, of which the deceased partook very freely.

He then commenced wrestling with one of his companions, and strained himself in the abdomen. This took place at about eight o'clock in the evening. He walked home (which was about a mile from the spot where he fell), went to bed, and complained of the most intense pain from this time until his death, which took place fifty hours after the accident.

At the post-mortem examination, the abdomen was very much distended, and upon opening it a quantity of fetid gas escaped. The small intestines were glued firmly together by lymph, showing that there had been severe peritonitis, and, after a deal of trouble, a small aperture, which would not admit a pin's head, was found in the jejunum. The aperture seemed to have been the result of an ulcer, which had commenced on the outer (antimesenteric) surface of the intestine, and the man in his fall having strained himself, there can be no doubt that the ulcer then gave way, and in this manner caused the man's death. Of course a verdict of "accidental death" was returned.

Case III.—(Cited by Richardson.[11]) (Reverdin: Bull. et mem. Soc. anat. de Par., vol. 12, p. 597, 1867.) A man of fifty-five, of alcoholic habits, died after two days' vomiting and obstipation. Autopsy showed evidence of peritonitis. On the right, halfway between the iliac crest and the liver, was an intestinal perforation. The stomach and duodenum were very slightly dilated. They presented no alteration of their mucosa. The mucosa of the intestine was normal throughout, except at the level of the perforation. The latter was situated on the free border of the intestine, at the level of the middle part of the jejunum. It was almost round, the size of a fifty-centime piece. Its margins, shaped as by a punch, were a little thick, and turned back from the serous side. No foreign body was present in the intestine. The remaining organs were essentially negative. No lesions of the abdominal aorta were present.

Case IV.—(Cited by Richardson.[11]) (Perroud: Les Ulcers, simple de l'intestine. These de Doct., Toulouse, 1897. Abstract from Combes. Soc. des Sciences Med. de Lyon, vol. 6, p. 3, 1867.) A cooper, thirty-two years old, in good health, suffered for three months from slight dyspepsia. While at stool he felt a violent colic, soon followed by three periods of syncope. The pain continued; symptoms of peritonitis and obstruction developed, death occurring about thirty-six hours after onset. Autopsy showed acute diffuse peritonitis. No intestinal obstruction was found, but in the right hypochondrium in a loop of small intestine, near the end of the duodenum, a small rounded opening was demonstrated the size of a lentil, situated at the level of the mesenteric insertion, communicating with the interior of the intestine, and explaining the presence of gas and fæces in the peritoneal cavity, as well as the acute peritonitis. The walls of the intestine, in the neighborhood of the perforation were red, a little thickened, and much softened. The remainder of the digestive tube was entirely sound. No alteration was found in the other organs. Tubercles were nowhere in evidence.

This case appears to be an example of simple ulceration of the small intestine, which one can compare with those ulcerations of the stomach which develop without much inflammation, and which only show themselves during life by very slight symptoms of dyspepsia.

Case V.—(Cited by Richardson.[11]) (Simpson: Practitioner, vol. 58, p. 165, London, 1897.) A man of fifty-six, by trade a maltster, whose mental condition at death was one of dementia consecutive to chronic mania, collapsed and died suddenly. He was accustomed to devouring filth and rubbish of all sorts. He had complained only of slight pain and constipation. Autopsy showed no marks of injury. The peritoneal cavity contained about thirty ounces of blood-stained serum, but no fecal matter. The mucous membrane of the alimentary canal was normal, except at a point six inches below the beginning of the jejunum, where there was a single ulcer about six millimetres in diameter irregularly circular in outline and with clean-cut edges which

showed no signs of chronicity, perforating through all its coats. A few shreds of wood fibre were the only foreign bodies in the alimentary tract, and no extraneous substance was discovered in the peritoneal cavity. The gall-bladder contained stones. The heart showed hypertrophy and dilatation; there was well-marked degeneration of the myocardium; the aortic valves were somewhat thickened. Both kidneys were in an advanced condition of interstitial nephritis.

CASE VI.—(Cited by Richardson.[11]) (Dodson: British Med. Jour., vol. 1, p. 718, 1906.) A death from an unusual cause has given occasion for an inquest in Battersea Coroner's Court. The deceased person, a horsekeeper, aged fifty-seven, who had been in and out of the workhouse for about seven years, had at various times been under the treatment of Doctor Dodson, the medical officer to the workhouse, for hydrocele, stricture, and chronic valvular disease of the heart. Death was proved on post-mortem examination to be traceable to perforation of a small chronic ulcer of the small intestine, about eight feet from the stomach; it was about one-quarter inch long by one-eighth inch wide; through this a few drops of fecal matter had percolated, and there were signs of commencing peritonitis.

CASE VII.—(Cited by Richardson.[11]) (Schmilinski: Muenchen. med. Wchnschr., vol. 57, p. 1616, 1910.) Schmilinski, in 1910, reported a case of stenosing ulcer of the jejunum. The patient, a woman of sixty-three, had for years pain in the stomach with on two occasions vomiting of blood and melæna. Findings, three years ago, obstructive incompetence of stomach with residue; hypersecretion. *Diagnosis.*—Stenosing ulcer of the pylorus or duodenum. Until January, 1909, she was free from pain by means of diet and lavage, when a recurrence of the pain developed. In the fasting contents, no free hydrochloric acid was found, instead of which was an admixture of bile. Air blown into the stomach emptied itself into the duodenum remarkably quick for a pyloric stenosis.

At operation the duodenum and beginning of the jejunum were found dilated. Four centimetres below the duodenojejunal fold was a stenosing induration of the jejunum and adjacent mesentery. Resection; recovery. The specimen showed on the mesenteric border of the stenosis a small ulcer, which, as well as its surroundings, showed microscopically the signs of chronic inflammation.

CASE VIII.—(Cited by Richardson.[11]) (Cade et al.: Progres med., No. 24, p. 309, 1913.) Cade, in 1913, reported the case of a man, aged twenty-five, a grocery clerk, who entered the hospital June 23, 1912; died June 24, 1912. His health was habitually good. He denied excessive drinking and syphilis. A month ago, he had moderately severe pain in the left iliac fossa, relieved by medicine, so that he was able to continue work. Ten days ago the pain returned. A large mass was found at this time in the left iliac fossa. He then improved somewhat and was able to come on foot to the hospital. At 8 P.M., shortly after his arrival, he felt a violent, stabbing pain in the lower abdomen. Copious vomiting, complete obstipation, hiccough and the development of great distention ensued. Collapse and death occurred the next morning. Autopsy showed the abdomen full of pus. In the left iliac fossa the intestine presented a perforation; pressure forced out the contents. The perforation was situated in a loop of small intestine adherent to the pelvic colon. On dissecting the intestine, nothing abnormal was found in the large intestine or appendix. In the small intestine, about sixty centimetres below the duodenum, the affected loop was found. At this point there was a thick circular zone formed of fibrous tissue, about one centimetre in breadth, which, however did not cause a stenosis. Immediately above this zone there was a blackish, necrotic area, and it was at the middle of this that the perforation was situated, about five millimetres in diameter, with ragged edges. The remaining small intestines were negative, as were the kidneys, heart, and lungs. Many mesenteric glands were hypertrophied. Microscopical examination of the edge of the ulceration showed thickening of the intestinal wall, inflammatory infiltration, and necrosis of the mucosa. No change was

found suggestive of tuberculosis. A section of the mesenteric gland showed recent inflammatory changes.

CASE IX.—(Cited by Richardson.[11]) (Bryan, R. C.: Surg., Gynec. and Obstet., vol. 22, p. 279, 1916.) W. H. M., aged forty-eight, white, inspector. Family history, negative. He never drank or used tobacco. In the last four years he has had severe attacks of indigestion with increasing frequency of late, characterized by violent cramps in the region of the stomach. Two years ago he had constant pain and nausea which continued for four months. The patient had been unable to do any regular work in the past three years.

September 8, 1915, at 1 A.M., while employed as an inspector in a munition factory, he was suddenly seized with a most agonizing pain in the abdomen and groins. He was brought to Grace Hospital at 3 A.M., two hours after the sudden seizure.

The patient positively refused operation and consented only at 8 P.M., seventeen hours after the onset, with temperature, 101°; pulse, 114; and respiration, 38.

Ether anæsthesia, right rectus incision. The peritoneal cavity was full of greenish fluid with flakes of lymph and food particles floating about in it. The stomach was atrophic, hard, bound down, pulled to the left, and firm, the walls white and heavy, the omentum shrunken and thick. The duodenum was plastered down, the jejunal wall was likewise indurated, whitish and thickened, and on its anterior wall about three inches from the duodeno-jejunal juncture, a round punched-out ulcer, the size of a cherry stone, was found. The induration of the jejunum extended several inches below the point of perforation, and tapered off gradually in the jejunal wall. The patient's condition was desperate, on account of the great thickening, diminished lumen, and fixed position of the stomach, duodenum and jejunum, no anastomosis could be made, purse-string and invagination were impossible. A piece of omentum was plugged into the opening and several retaining catgut sutures sewed over it; the belly was irrigated with warm saline. A large drainage tube was inserted and a stab wound made into the pelvis. The patient died the next morning at 10 o'clock. Autopsy refused.

CASE X.—(Kretschmer, J.: Deutche med. Wchnschr., vol. 46, p. 69, 1920.) A thirty-nine-year-old male, complaining of abdominal pain for three months. He had had diarrhœa alternating with constipation. He had been vomiting. An X-ray showed retention of barium in the upper small intestinal loops. At operation a mass, the size of a fist, was found in the upper left abdomen, consisting of omentum, posterior surface of the stomach, transverse colon and jejunum. The jejunum perforated while it was being separated from the mass. A part of the jejunum and the omentum were excised.

Pathology.—A cicatrized ulcer encircled the jejunum. There was no perforation found except that made when the jejunum was separated from the mass. The patient died a few days after operation from symptoms of obstruction and acute heart failure.

CASE XI.—(Richardson, E. P.: Surg., Gynec., and Obstet., vol. 25, p. 1, 1922.) W. S., female, aged forty-eight, married, born in Russia. Admitted March 3, 1912, with diagnosis of intestinal obstruction, peritonitis. For years she has been subject to pain in the heart after eating, and has vomited a great deal.

Patient has been indisposed for about seven weeks. A week ago she began to have severe pain about the heart and vomited occasionally every day. Repeated enemas have failed to give anything like good results. Tenderness is present through the whole abdomen, more particularly in the epigastrium. No visible peristalsis is observed. Rectal examination shows nothing except increased abdominal tenderness.

On median suprapubic incision, thin, cloudy fluid and fibrin flakes without odor were found. Intestines were distended and injected. Exploration shows a mass in the right upper quadrant. A transverse five-inch incision was then made along the right costal margin. The tumor was brought into the wound and was found to be a loop of jejunum six inches long, twisted, and kinked and bound down by adhesions. On freeing the adhesions, fecal matter escaped from a perforation in the gut. No attempt was

made to locate the portion of gut which was involved, but it seemed to be the middle of the jejunum. The bowel on one side of the kink was collapsed, on the other distended. A loop, six inches in length, was resected and an end-to-end anastomosis done with Pagenstecker. The transverse incision was closed with drainage of the superficial fascia. A rubber tube was left in the pelvic wound. The specimen is a piece of intestine fifteen centimetres long. The serous surface is injected and covered with fibrin. Section shows the walls and mucosa considerably darkened with a soft, moist appearance. A ragged, circular perforation through all coats 1½ centimetres in diameter is present in one extremity of the gut. The intestine on one side of the ulceration is 8½ centimetres, on the other side 2½ centimetres in transverse diameter.

Microscopical examination of the edge of the ulcer showed a little granulation tissue but no evidence of any new growth. The blood-vessels in the immediate vicinity were not especially altered or thrombosed.

Diagnosis.—Simple ulcer. Discharged, March 23, 1912.

CASE XII.—(Richardson, E. P.: Surg., Gynec., and Obstet., vol. 25, p. 1, 1922.) E. S., male, aged forty-seven. Admitted January 11, 1920, with the following history. In July, 1919, the patient had an attack of severe general abdominal pain, lasting six hours, during which he vomited. In September, 1919, a similar attack occurred. There were no gastric symptoms between July and September. Since September he had had occasional attacks of transient, but rather severe, pain localized in the left abdomen. For two weeks he noticed that his bowel movements have been black although no medicine has been taken except epsom salts and cascara. Later the patient was seized with severe abdominal pain in the left lower quadrant, radiating to the left flank and shoulder. The pain has persisted. Patient was a well-developed and nourished man, looking rather weak, evidently suffering some pain but not in shock.

The abdomen was tympanitic throughout, the tympany extending three centimetres above the costal margin; the liver dullness reaching from this point to the sixth intercostal space. The left side was rigid, and there was tenderness about nine centimetres below the left costal margin in the left flank. There was spasm over this area of tenderness.

Operation.—3:20 P.M., January 11, 1920. (Ether.) Cloudy fluid was found on opening the peritoneal cavity through the upper left rectus muscle. A perforation of the stomach or duodenum was looked for, but these organs were negative. A small mass was then felt in the bowel, slightly adherent to the posterior abdominal wall, in contact with the splenic flexure. On delivery this proved to be small intestine. The induration was due to a stricture, on the anterior surface on which was a perforation one-eighth inch in diameter. At first, attempt was made to close this perforation by excision and suture similar to Heinecke-Mikulicz pyloroplasty. On opening the gut, however, an annular ulcer encircled the bowel at the point of stricture, through which perforation had taken place, and the amount of constriction and induration made a plastic procedure impossible. An atypical resection was done, removing the ulcer and its margins, without the adjacent mesentery, followed by an end-to-end anastomosis. A resection of the whole loop would have proved easier. The level of the stricture was not exactly determined on account of the patient's condition. It was believed to be within two feet of the end of the duodenum. Closure was without drainage. The pathological examination showed a number of irregular fragments, the largest of which contains part of an ulcer in its mucosa. Its edge is slightly raised and its base is rough. At one portion of the base there is a small perforation passing directly through the wall of the gut. Its peritoneal surface is covered with plaques of fibrin.

Microscopical examination shows an ulcer, whose surface is covered with necrotic exudate. Its base is formed by fibrous tissue which extends through the entire thickness of the wall. There is considerable inflammatory exudate on the peritoneal surface. There is no evidence of tuberculosis or malignant disease. *Diagnosis.*—Chronic ulcer.

The patient made a good recovery without complications, and was discharged February 3, 1920.

CASE XIII.—(Chiasserini: Ann. Ital. di chir., vol. 1, p. 973, 1922.) This male patient was brought in with the signs of acute diffuse peritonitis which came on after taking an aperient. At operation a lentil size perforation in the jejunum surrounded by a hardened area two centimetres in diameter was found, one centimetre below the duodeno-jejunal junction. Death occurred forty-eight hours after operation. Microscopical diagnosis of the ulcer of ulcer simplex.

CASE XIV.—(Walton, A. J.: Brit. Jour. Surg., vol. 10, p. 152, 1922.) Patient, a forty-five-year-old female, who for nineteen years had had general abdominal pains recurring rather regularly every two months, and lasting from one to two weeks. Her pain before operation had become more frequent, occurring practically daily, and localizing in the epigastrium. It was most severe late after eating, and she was usually relieved of her pain during meals. At operation the following was found: An indurated inflamed area, two inches long in the jejunum, three feet from the ligament of Treitze. The omentum was adhered to this region. The mesenteric lymph-nodes were swollen. Resection of the area was done, and the continuity of the gut was re-established by an end-to-end anastomosis.

Pathology.—A round ulcer, with a smooth base comparable to a chronic ulcer of the stomach, was found with chronic inflammatory destruction of the mucosa and muscularis. There was no evidence of tuberculosis or lues. Wassermann—negative. Patient recovered. Laparotomy one year later for another surgical condition showed the gut of the resected area to be normal. Two and one-half years following the operation, the patient was symptomless.

CASE XV.—(Fischer, H.: ANNALS OF SURGERY, vol. 77, p. 775, 1923.) Female, aged forty-two, entered the Lenox Hill Hospital May 23, 1922, for the relief of (1) intermittent epigastric pain; (2) dyspnœa; (3) profuse night sweats; and (4) slight hoarseness.

Her physical examination was conducted with the utmost care and thoroughness. She remained in the hospital about two weeks. She was on soft diet; was kept out of doors in the sunshine as much as possible and received Blaud's pills two thrice daily, and Fowler's solution m. v. thrice daily before meals. She left feeling improved. A repeated blood count showed practically the same hæmoglobin percentage and red blood-cells, and she was discharged with the diagnosis of a secondary anæmia of unknown origin.

August 25, about two months later, she returned complaining of gradually increasing weakness with dizziness, palpitation, dyspnœa, cyanosis and also paleness after exertion. It originated in the right loin, radiated to the right scapular region and was worse at night. Physical examination as before was almost entirely negative. Red blood-cells, 1,600,000; hæmoglobin, 25 per cent. Blood transfusion was done August 27. On discharge red blood-cells, 2,800,000; hæmoglobin, 34 per cent. Discharged September 23 improved, with diagnosis unchanged. During the following months her stools still showed blood, she lost four pounds in weight, had no appetite, no pain, and her anæmia increased. October 4 was admitted and on October 8 was transfused with 550 cubic centimetres of blood. The next day an exploratory laparotomy was done by Doctor Fischer.

A long median incision from ensiform almost to pubes was made. The exploration of the large gut, stomach, gall-bladder and other organs revealed no macroscopical pathology. At the duodeno-jejunal junction an induration of the wall of the jejunum was found, about the size of a quarter (Fig. 2). The wall of the gut was irregular, very much thickened and œdematous. The serosa of the intestine was scarlet red and covered with a few flakes of fibrin. This œdema and inflammatory thickening was also noted in the root of the mesentery and above the intestine in the mesocolon. The retroperitoneal portion of the duodenum was also implicated in the process. The diagnosis

of a primary ulcer of the jejunum was made and it was decided to do a retrocolic duodeno-jejunostomy. The descending portion of the duodenum was mobilized after Kocher, pulled through a hole in the mesocolon and anastomosed with the jejunum about twenty-five centimetres below the seat of the ulcer. During the first forty-eight hours there was considerable vomiting which was finally relieved by gastric lavage, thereafter a smooth convalescence. She still has blood in her stools. Blood examination showed the following: Red blood-cells, 2,560,000; hæmoglobin, 35 per cent. at her reëxamination on February 11, 1923, but all her pain and discomfort and the anorexia from which she suffered have disappeared. She has gained about ten pounds.

Patient died four years after the hernioplasty in a public institution from some intercurrent disease. There was no autopsy and the cause of death is not known.

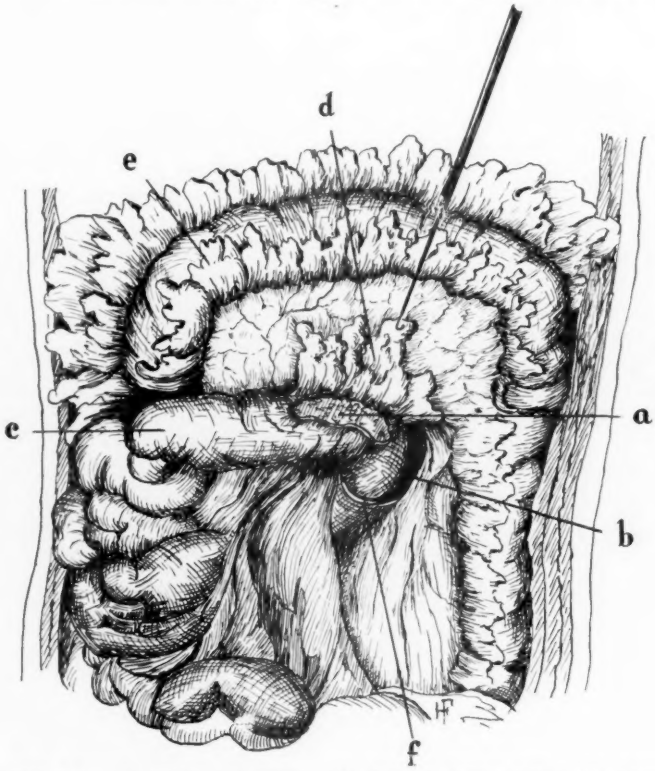

FIG. 2.—Case XV.—(a) Ulcer of jejunum. (b) Duodeno-jejunal fossa. (c) Jejunum reflected to the right. (d) Inflamed fat tufts derived from mesocolon, covering the ulcer, they have been dissected off and are reflected upward and retracted by tenaculum. (e) Colon transversum reflected upward. (f) Ligament of Treitz.

CASE XVI.—(Velte, H.: Zentralbl. f. Chir., vol. 51, p. 135, 1924.) A seventy-seven-year-old female, who was suddenly seized with a violent left lower abdominal pain. She vomited and fainted. On admission she was distended and there was marked left-sided tenderness. At operation a perforated jejunal ulcer the size of a ten-pfennig piece was found. It was excised and sutured. Patient died twelve weeks after operation from progressive weakness and bronchitis.

CASE XVII.—(Ravdin, I. S.: ANNALS OF SURGERY, vol. 85, p. 873, 1927.) Male, S. K. (History Nos. N. S. 6606–7218), was first admitted to the University Hospital in August, 1925, with a chief complaint of pain in the epigastrium, belching, vomiting and loss of weight. He had been troubled for six months with constipation, dull upper abdominal pain, gaseous eructations and vomiting.

His past medical history was negative. The physical examination was negative except for slight tenderness in the right lower abdomen. There was no abdominal rigidity, no distention and no masses were palpable. The tentative diagnosis was duodenal ulcer.

Operation.—September 3, 1925. Appendectomy. Operator, Dr. G. P. Muller. A McBurney incision was then made and a chronically diseased appendix was removed through this incision. There were numerous peri-appendiceal adhesions. After operation the patient vomited daily. The vomitus was bile-stained. He was discharged from the hospital September 19, 1925. He did not return until November 15, 1925. Since discharge he had become progressively worse. The X-ray examination at this time showed a high jejunal obstruction. The abdomen was scaphoid, the peristalsis was about normal and no masses were palpable. There was some tenderness in the mid-abdomen. He was given enteroclysis of tap water and saline hypodermoclysis for twenty-four hours before operation, which was performed by Doctor Muller December 1, 1925.

Resection of jejunum, gastro-enterostomy-posterior method. Left rectus incision. When the peritoneal cavity was opened, a small contracted bowel presented itself. This was followed upward toward the jejunum. About twelve inches from the duodeno-jejunal flexure a loop of dilated small bowel was encountered. On bringing this up into the wound the site of obstruction was easily seen. This consisted of an annular, sclerosing mass encircling the jejunum, while in the surrounding mesentery were numerous large lymph-nodes.

It was felt that the mass was either a sarcoma or a carcinoma. Resection appeared imperative so that this was done and the bowel brought together by end-to-end anastomosis. A posterior gastroenterostomy was then done, the loop being distal to the anastomosis. For two days his convalescence was uneventful, but on the evening of December 3 he began to vomit. A Jutte tube was introduced into the stomach for drainage. The abdomen became soft, the gastric distention was relieved and the patient improved considerably for twenty-four hours. The following day we gave him glucose and insulin intravenously. On December 7 his condition became worse; he began to vomit large amounts of bile-stained fluid; the pulse rose rapidly and his appearance was that of a high intestinal obstruction. Under gas-local anæsthesia, I opened the abdomen with a high left rectus incision. The stomach was opened along the greater curvature and the gastroenterostomy opening was found. There was a great deal of bile-stained fluid in the stomach which was aspirated.

He improved temporarily, but on December 9 developed circulatory incompetency with cyanosis and dyspnœa, and died. The pathological report was: Specimen consists of part of the jejunum, which is the seat of a rather large, irregularly outlined ulcer. The lymph-glands in this region of the jejunum were extremely large and pressing against the wall so as to produce a bulging within the lumen of gut.

Microscopical Examination.—Sections of the gland show chronic inflammatory tissue. Sections from the ulcer margin show chronic inflammatory tissue. *Diagnosis.*—Chronic lymphadenitis and chronic jejunal ulcer.

CASE XVIII.—(Pickhardt, O. C.: ANNALS OF SURGERY, vol. 91, p. 291, 1930.) Female, aged sixty, was admitted to the Lenox Hill Hospital December 24, 1927. Her present history dated back three weeks, at which time she had her first attack of generalized abdominal cramps associated with vomiting. These cramps were intermittent in character and quite severe. On the day previous to admission she had had her severest attack and the vomiting had lasted throughout the entire night. During this time she had several bowel movements, although as a general rule she was markedly constipated. She was fairly well nourished, and did not appear acutely ill. The abdomen was moderately distended, but there was no rigidity and no definite points of tenderness. There was more tympany over the upper portion than over the lower. No masses were palpable, and there were no operative scars. No visible peristalsis could be seen.

In the right groin, more in the area of the femoral region than in the inguinal, there was a walnut-sized, soft, freely movable, rather tender mass, which gave a slight impulse on coughing, but did not change in size when the patient coughed or stood (patient states that she had had this for years). This mass gave the impression of being an irreducible, but not strangulated, hernial protrusion of long standing. The remainder of the physical examination was irrelevant. The temperature, pulse and respiration were normal. Blood-pressure, 170/90.

The patient was evidently suffering from some type of partial, intestinal obstruction, which at present had relieved itself. She was observed for a period of two weeks, during which time she had several attacks, similar to those described above. Finally, after a particularly severe attack, she was operated upon January 9, 1928. In the large intestine nothing abnormal was found except that the sigmoid was rather redundant. Several unexplained bands of adhesions and bands of omentum were found and loosened. The small intestine was found partially distended. The distended gut was then followed and within about five feet it ended at the duodeno-jejunal flexure. The distal end was then examined and within about a foot there was found a firm, thumb-sized circular stricture about 1½ inches long. This felt quite firm and was slightly reddened and injected, but showed no evidence of ulceration on the serosal surface; a chronic inflammatory process within the lumen of the gut, possibly carcinomatous in nature. After observing it for a time and seeing that no change occurred, it was decided to resect about six inches of the jejunum.

The specimen, received in the fresh state, consisted of an eleven-centimetre-long piece of intestine. A two-centimetre-wide band of tissue divides the specimen into a dilated proximal part (six centimetres long and six centimetres in circumference) and a narrow distal part three centimetres long and four centimetres in circumference). The obstructing band of tissue feels distinctly harder than the rest of the intestine. The mucosa over this area has been ulcerated away, and the floor of the ulcer presents a granular appearance.

Microscopically, sections of the gut showed a superficial ulceration, which was confined to the mucous membrane. The floor of the ulcer was composed of granulation tissue crowded with lymphoid cells, plasma cells, and polymorphonuclear leucocytes. The submucosa was greatly thickened by fibrosis and œdema, and irregularly infiltrated with many small round cells and plasma cells. The muscular and serous coats show fibrosis and an inflammatory cell infiltration of a lesser grade. There was no suggestive vascular lesion.

Her recovery was uneventful and several complete X-ray examinations taken at yearly intervals showed no further evidence of obstruction. Her symptoms have disappeared, she has gained weight and feels well.

Case XIX.—(Schilling, H.: Om ulcus simplex i tyndtarmen. Meddelelse om et tilfaelde med perforation. Miltatrofi som filfaelding fund. (Simple Ulcer of the Small Intestine. Report of a Case with Perforation. Atrophy of the Spleen as a Chance Finding). Norsk Mag. f. Laegevidenskapen, vol. 89, p. 249, 1928.)

The author describes a case in a woman of forty-seven admitted August 6, died August 8. For many years she had had attacks of intestinal cramps and for the past year had been weak and anæmic. On the night before admission while nursing a sick child she suddenly had such intense abdominal pain that she thought she was going to die. No vomiting. No fæces or gas passed after that. On admission next morning she had pain over the whole abdomen. Stertorous respiration. Pulse, 88; good quality. Temperature, normal. Abdomen, distended. Muscles of the abdomen, rigid and painful on palpation everywhere, particularly on the right side.

Diagnosis.—Perforated ulcer. Operation at once, six and one-half hours after the beginning of symptoms. Crucial incision in the right iliac fossa; some clear fluid containing flakes of fibrin; no hæmorrhage; appendix normal. A median epigastric incision was then made; clear fluid, no air. A small body was felt at the site of the

spleen and on attempting to examine it more closely there was quite severe hæmorrhage apparently from a tear in the peritoneum high up on the posterior wall. It was impossible to determine whether it had been caused by the manipulations. No intestinal perforation could be demonstrated and no ovarian cyst found. In view of the abnormal condition of the spleen the author thought of the possibility of a ruptured cyst of the spleen. The hæmorrhage stopped spontaneously. Abdomen irrigated with salt solution and closed. After temporary improvement peritonitis developed and the patient died two days after admission. Autopsy showed diffuse peritonitis. After a long search a small perforation was found on the convex side of the intestine about one meter from the duodeno-jejunal flexure. The opening was the size of a large knitting needle. The serosa around it was normal. The perforation was in the middle of a cup-shaped ulcer the size of a pea. The edges of the perforation were infiltrated but the wall of the intestine around it was normal. The spleen was very small, normal in form. The mucous membrane in the ulcer was semi-necrotic and infiltrated with round cells. Around the ulcer the tissue was infiltrated with lymphocytes and there were many small, relatively new-formed vessels. No signs of either tuberculosis or tumor. There was no thrombosis of any vessel of any size but there was thrombosis of some of the smaller vessels. The spleen showed remnants of splenic tissue in the midst of sclerotic connective tissue with thickened vessels.

CASE XX.—(Black, J. M.: Brit. Jour. of Surg., vol. 17, p. 338, 1929.) D. H., a miner, aged fifty-three years, was admitted to the Dunfermline and West Fife Hospital February 10, 1928, about 8 P.M.

History.—At 4 A.M. on February 10 he was awakened with sudden very acute pain in the epigastrium, and vomited some mucus. The pain became localized to the right iliac region, and although the bowels operated there was no abatement of pain. He had no more vomiting, no shoulder-tip pain, and no symptoms affecting micturition. He has had no indigestion or previous trouble with his stomach or bowels, although on closely questioning him after operation he admitted having had a little flatulence lately.

Examination.—The man looked ill, his face was gray and drawn, and he was moaning with pain. The temperature was 99° and the pulse 68 per minute. The abdomen was retracted and movement of the abdominal muscles was very limited. Rigidity and tenderness were generalized. There was no loss of liver dulness. The *diagnosis* was: Perforated gastric ulcer, or ruptured appendix.

Operation.—Operation was performed at 8:30 P.M., sixteen hours after onset of his symptoms. The abdomen was opened through the right rectus sheath. The parietal peritoneum was congested, and on opening it there was a rush of green watery fluid. The cæcum, which was delivered, was large, and a normal appendix was removed. The incision was extended upwards, and the gall-bladder, although distended, was normal. The stomach and duodenum were congested, but no perforation or ulcer was present, and no lymph was observed in this region. The transverse colon was delivered and the left hypochondrium investigated. In this region there was a large amount of green lymph. The jejunum was traced from the flexure. At a point about two feet from its commencement and on the antimesenteric border, a congested area about the size of a sixpence with a yellow slough or plug of lymph in its centre was seen. The plug was sponged off, and intestinal contents, green watery fluid, appeared through the perforation, which was the size of a match head. The portion of the jejunum bearing the ulcer was excised and a lateral anastomosis performed. A suprapubic glass drain was inserted and the abdomen was closed; eighty cubic centimetres of *B. welchii* antitoxin were administered intramuscularly.

The patient made a good recovery although his wound was infected, and he was discharged feeling very fit on March 14, 1928.

The resected portion of the intestine was examined by Doctor Harvey, of the Royal College of Physicians' Laboratory, Edinburgh, who reported as follows: Microscopically there is evident a small ulcer of the mucous membrane, and a section through

this shows continuity with a minute perforation on the serous surface. Microscopically, there is an acute inflammatory cell (pus) reaction, with exudation extending from the Lieberkuhn's glands of the mucous membrane to the peritoneum. On the peritoneal surface there is a fibrinous necrotic exudate indicating the position of the perforation.

CASE XXI.—Jancke, C. E.: Zur Perforation des einfachen Dunndarmgeschwurs. Zentralbl. f. Chir., vol. 56, p. 1222, 1929. Patient was a male of twenty-eight, in whom at operation a perforation the size of a pfennig in the jejunum about thirty centimetres below the ligament of Trietz was found. The diagnosis was not made before operation, the signs and symptoms were not given. There was a possibility that a trauma might have been an etiological factor in this case.

CASE XXII.—*Spontaneous Perforation of Primary Jejunal Ulcer.* (Morrin, F. J.: Irish Jour. of Med. Sci., sixth series, p. 198, 1931.)

L. M., male, aged sixty-five, suffered six months from gradually increasing constipation and pain in left iliac fossa. I was called to see him about noon of the following day, twenty-four hours after the commencement of the attack.

He then presented the typical picture of acute general peritonitis, hippocratic facies, distended abdomen, cyanosis, absence of liver dullness, and with tenderness most marked in the left flank.

On operation I found a quantity of yellowish-brown fluid in the abdomen, the intestines distended and injected, but the appendix, duodenum and stomach normal. The purple intestines were rapidly eventrated and a perforation of the jejunum, the size of a pea, was found on the free border of a coil of small intestine, which lay in the left iliac fossa, approximately eighteen inches from the duodeno-jejunal junction. This crater-like perforation was surrounded by indurated tissue, while the mucosa pouted through the opening from which intestinal contents poured freely. Simple closure of the ulcer was performed, and the abdomen drained, but death occurred eight hours later.

CASE XXIII.—(Morrin, F. J.: Irish Jour. of Med. Sci., sixth series.) A woman, aged thirty-nine, was admitted to a maternity hospital as an acute abdominal emergency. On examination she was complaining of great abdominal pain, localized chiefly to the suprapubic region and left flank. The lower abdomen was distended, diffusely tender, but not markedly rigid. Liver dullness was not lost; rectal examination showed tenderness of the pelvic peritoneum anteriorly. A diagnosis of diffusing peritonitis was made, and operation undertaken. A mid-line lower abdominal incision revealed a normal appendix, a small amount of turbid peritoneal fluid, and slight inflammatory changes in the peritoneum of the left pelvic cul-de-sac. Exploration of the stomach and duodenum was negative; a hurried examination of the small bowel showed a few flecks of lymph here and there, but no lesion was evident, and the abdomen was closed, leaving a drainage tube in the pelvis. Death occurred six hours later, and autopsy revealed a tiny pin-point perforation on the free border of the jejunum, two feet from the duodeno-jejunal flexure.

CASE XXIV.—(Morrin, F. J.: Irish Jour. of Med. Sci., sixth series.) Female, aged forty-seven, admitted to the hospital complaining of acute abdominal pain of two days' duration, which had commenced suddenly around the umbilicus and was associated with frequent bilious vomiting. For two months previously she had occasional mild attacks of waterbrash, a stitch in her left side, and suffered from constipation. Two months before admission to the hospital she had been treated for pneumonia, and, following her recovery from this, she became affected with rheumatoid arthritis of the hands and feet.

Examination showed a distended lower abdomen, which was diffusely tender, with the tenderness more definitely marked in the left iliac fossa than elsewhere; the muscles, though rigid, did not give the sensation of boarding usually associated with acute perforation; liver dulness was present, and rectal examination showed acute tenderness of the pelvic peritoneum. The tongue was dry and coated, the temperature subnormal,

the pulse weak and rapid—140 per minute—the patient was complaining of great pain and was obviously very ill.

A small incision over the appendix allowed a gush of greenish, watery fluid to escape, while exposing a normal appendix. An upper abdominal incision showed a normal stomach and duodenum. The first loop of the jejunum was distended; its surface was covered with plaques of greenish lymph; it felt as if it was stuffed with wool, and peristalsis was absent. Examination of the mesentery showed the vessels pulsating normally. Wiping off the lymph uncovered normal serosa. A search for a perforation of the small bowel was immediately begun. Fortunately a hand passed into the left pelvis came in contact with a mass which, when withdrawn, revealed an indurated, annular constriction of the bowel. On the antimesenteric border was a perforation, from which yellowish intestinal contents were pouring freely out into the peritoneum. The perforation was the size of a duodenal perforation. The arrangement of the mesenteric vessels (which showed normal pulsation) at the site of the perforation, with two groups of arterial arcades, indicated the terminal jejunum as the site. The perforation was closed transversely, an enterostomy tube placed in the upper jejunum, and the abdomen closed with a drain in the pelvis. The jejunal tube did not drain for the first twenty-four hours, after which profuse drainage occurred. After a further forty-eight hours, fluids administered through it were retained. It was removed on the fourth post-operative day. The patient made an uninterrupted convalescence from the abdominal condition. The affection of the joints, however, persisted, and detained her in the hospital for many weeks.

Case XXV.—(Ebeling, W. W.: Annals of Surgery, vol. 97, p. 857, 1933.) Colored male, aged thirty-six. Admitted to the surgical service of Dr. E. L. Eliason at the Hospital of the University of Pennsylvania October 6, 1931.

History of Present Illness.—Patient was apparently well until 1925, when he began to suffer from indigestion. He suffered from a continuous pain in the mid-epigastrium, persisting over a period of from six to eight weeks. The pain was somewhat relieved by belching, but was apparently not severe because the patient was able to continue doing light work. There were intervals of complete freedom from symptoms which lasted for several months at a time.

In 1927 the patient suffered from melæna; black stools persisted for five days. He had some loss of appetite, but very little pain. He remained under a physician's care for three or four months at that time.

In September, 1930, the patient had a most severe attack of indigestion with vomiting of food and bile associated with epigastric pain. He was admitted to the Atlantic City Hospital where he remained for a period of ten days. A röntgenological study was not made. He was placed on a Sippy diet, to which he strictly adhered for four months. This diet was then modified and continued with little alteration to the present time.

The pain associated with the attacks of indigestion was described as being in the mid-line of the epigastrium. It was lancinating in type, as though a person took a razor and kept making short cuts. Pain of this type would also occur about one hour after meals with occasional relief after food or alkaline powders. Further points in the history of present illness are not essential.

Physical Examination.—Patient was a slender, poorly nourished colored male, thirty-six years old, who appeared to be ill. Temperature, 99° F.; pulse, 80; and respiration, 22. The abdomen presented moderate tenderness to palpation in the left upper quadrant, and in the epigastrium.

Röntgenological Studies.—Gastro-intestinal series. Œsophagus, negative. Stomach, negative. Duodenum, cap negative by screen examination, unfilled on the films. Stasis in the duodenum and jejunum with obstruction is the first part of the jejunum due to ulcer or adhesions. Remainder of small intestine, negative. *Pre-operative Diagnosis.*—Jejunal ulcer.

Operation.—Under spinal (neocaine) supplemented with gas-ether anæsthesia a mid-line incision was made from the ensiform to the umbilicus. Stomach prepylorus, pylorus, and duodenum were first examined and found to be entirely normal. Gall-bladder, normal. Examination of the jejunum revealed a stenosing lesion involving almost the entire circumference of the bowel and causing a partial obstruction six inches from the ligament of Treitz. The bowel proximal to the stenosis was distended and hypertrophied. Palpation revealed only moderate induration and the impression was that the condition was probably a jejunal ulcer.

Approximately four inches of the jejunum were resected, thus completely removing the ulcer-bearing portion of the bowel. After inversion of the cut ends of the proximal and distal jejunum, continuity was restored by lateral anastomosis.

Progress.—Patient reacted promptly and satisfactorily after operation. Wound healed by primary union and the patient was discharged from the hospital on the seventeenth post-operative day much improved.

Pathological Report.—Specimen consisted of part of the jejunum which measured about five centimetres in length. In the middle there was annular ulcerating lesion. The ulcer was shallow, and its base was covered with small blood-clots. There was no gross evidence of infiltration. Sections showed the ulceration down to the muscularis mucosa. There was small round-cell infiltration and fibrosis. No evidence of tuberculosis. Levaditi stain did not demonstrate any spirochætes.

Follow-up Examination.—Approximately five months after operation, slight post-prandial epigastric discomfort immediately relieved by alkali. Otherwise completely relieved of symptoms, and feeling much improved. X-ray showed slight widening of the lumen in several coils of small intestine in the left upper quadrant, with small amount of regurgitation, but no obstruction. Hypomotility.

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ACUTE INTESTINAL OBSTRUCTION*

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A survey of the surgical literature on acute intestinal obstruction reveals an unusually large number of contributions to the subject during the past seven or eight years. This renewed interest must be attributed, to a great extent, to the recognition of the chemical derangement of the blood which is present in acute ileus, and particularly to the stimulating contributions of Haden and Orr.[1]

Ileus being regarded for many years as a catastrophe essentially mechanical in nature, the surgical attack upon it concerned itself solely with the immediate reestablishment of the continuity of the intestinal lumen. This procedure, though generally accepted, was obviously unsatisfactory, for even institutions of exceptional merit continued to report a mortality of 50 to 60 per cent,[2, 5, 10] and the average case of advanced obstruction came to be viewed as a practically hopeless surgical problem. Recent experimental studies with unanimous emphasis upon the importance of the perverted blood chemistry of the patient have diverted attention, hitherto focused on the local lesion in the intestine, to the constitutional change which accompanied that lesion. This new attitude toward ileus was welcomed as the first ray of hope in a field which had been dark for a quarter of a century. It may be as yet too early to evaluate properly and accurately the effect which our changed attitude has had on our final results. Nevertheless, a number of analyses which have appeared in recent months[5, 6, 10] seem to indicate that experiences have varied and that there exists as yet considerable doubt as to whether or not the chemical disturbances are as significant from the therapeutic point of view as was at first supposed.

This report from the Roosevelt Hospital in New York City is presented in the hope that, along with many others coming from similar institutions, it may shed some light on the multiplicity of problems involved in the successful management of intestinal obstruction.

I have collected from our files the last 200 cases of acute ileus admitted to the surgical wards. Only those cases have been included which presented an acute complete obstruction of the bowel; partial obstructions have been omitted. The ileus accompanying diffuse peritonitis has not been incorporated in this report because it was felt that the variety of factors involved in that type of case would serve only to obscure the issues in an analysis of this nature.

As shown in Table I, there were 69 deaths in this series, a mortality of 34½ per cent. Among the patients who died, the average duration of symp-

* Read before the New York Surgical Society, November 28, 1934.

TABLE I

Mortality

Total cases	200
Deaths	69
Mortality	34.5%

Duration of Symptoms

Cured cases	41.1 hours
Fatal cases	83.7 hours

Etiology

Type	Number of Cases	Deaths	Mortality
Hernia (external)	107	28	26.1%
Adhesions and bands	54	18	33.3
Intussusception	21	12	57.1
Volvulus	5	4	80.0
Meckel's diverticulum	2	0	00.0
Foreign body (gallstone)	3	1	33.3
Carcinoma	3	2	66.6
Cause not determined	5	4	80.0
	200	69	34.5%

Cases Showing Gross Interference with Mesenteric Circulation

(Excluding external herniae)

Adhesions and bands	13
Volvulus	5
Intussusception	21
Meckel's diverticulum	1
	40 (43% of 93 cases)

toms before admission to the hospital was 83.7 hours, as compared with an illness of 41.1 hours in those cases which survived operation. These figures on the relation of duration of symptoms to mortality are in reasonable accord with the findings of other institutions. They are so often encountered and so frequently repeated that their significance should be obvious, and, in the opinion of many, they indicate the most important issue that we have to face. The failure to recognize intestinal obstruction within a reasonable period is less the fault of the medical attendant than of the patient, as indicated by the histories of these fatal cases. Approximately one-half of those who died were either moribund or critically ill before medical advice was sought; before hospitalization was effected, most of them were virtually beyond help. It is hoped that with the dissemination of pertinent medical information among the laity, the number of people who now deny themselves the benefits of timely medical assistance will steadily diminish. The rôle of the doctor in early diagnosis is all-important. If the possibility of acute ileus be kept in mind, fewer cases will be missed. Doubtful cases should be hospitalized and immediate roentgen ray studies made. An early obstruction

will often reveal itself quite definitely by the so-called "herringbone" appearance of the obstructed loop of bowel. The more advanced case will usually show definite fluid levels in the intestine. To await the latter development, however, is to court disaster. We firmly believe that if there is any doubt as to the presence of an acute obstruction it is less hazardous to do an exploratory operation than to await the development of positive diagnostic signs. It is depressing, but at the same time instructive, to note that 36 of the 69 deaths in this series occurred in individuals who were moribund or critically ill on admission. Only nine were in fair or good condition.

During the past seven or eight years, as already mentioned, the perverted blood chemistry in acute ileus has been the subject of considerable emphasis. Indeed, so far has the pendulum swung that the local lesion in the intestine, with its attendant mechanical problems, has been relegated to a position of secondary importance by many and the chemical derangement which is uniformly encountered has been accepted as the outstanding pathologic change.[11] This new conception, naturally, has produced a revision of our preoperative routine. Prior to 1928, only an occasional case received preoperative hypodermoclyses or infusions. Since that time, however, replacement therapy, with the administration of large quantities of salt and fluids before and after operation, has become a standard procedure and only on rare occasions has any case of acute ileus been taken to the operating theater without preliminary intravenous infusions of saline and glucose. The anticipated improvement in our results, however, has not materialized. In the seven years prior to 1928, our files showed 115 cases with 41 deaths, a mortality of 35.6 per cent. Since 1928, we have had 85 cases with 28 deaths, a mortality of 32.9 per cent. This experience is similar to that of many of the institutions that have issued reports in the last two or three years. The failure to effect any reduction in mortality, though disappointing, is not entirely unexpected. The average clinical case of acute ileus presents problems which are quite different from those encountered in the experimental animal.[7] The effect of a simple, high intestinal obstruction produced in the laboratory is purely a matter of dehydration, demineralization, and starvation. The upper intestine is drained adequately by vomiting, there is no distention of any considerable length of bowel, and no ischemia and necrosis of intestinal wall. The mucosal lining remains essentially normal and effectively impermeable to any toxic substances which may form in the distended loops. The factor of toxemia is practically negligible and the animal may survive for weeks with an unrelieved high obstruction if adequate quantities of fluid and salt are administered. Unfortunately, only a very few of the clinical cases of ileus present the simple, uncomplicated picture of high obstruction which we produce in the laboratory. The great majority of clinical cases are obstructed at a point which is closer to the cecum than to the duodenum, allowing at least ten feet of bowel proximal to the obstruction which might become the seat of distention, ischemia and possibly necrosis. In addition, aside from the ischemia and damage to the intestinal wall which follow distention, about 40 per cent

of all cases (not including strangulated external herniae) will show some direct interference with mesenteric circulation.[4] In our series, 40 cases out of a total of 93, excluding herniae, showed changes ranging from marked discoloration and small gangrenous patches to complete devitalization of the affected segment. The chief problem, then, is obviously not one of simple occlusion, which is relatively uncommon and which usually responds readily to treatment. The problem which we have to face is more frequently one of obstruction, complicated by strangulation, microscopic or gross, and it is this group which accounts for almost all of the fatalities. It is not surprising, then, that the institution of replacement therapy has not materially reduced our mortality. Strangulation is predominantly a matter of toxemia, in which the factors of dehydration and demineralization, though present, are comparatively insignificant. The administration of salt solution in large quantities, while it may improve the general condition of the patient as an operative risk, has no proven specific value in combating the toxemia. When the toxin has become disseminated throughout the organism and fixed in the tissues, the outlook is practically hopeless.

Prior to the widespread use of spinal anesthesia the great majority of our patients received a general anesthetic, usually a sequence of nitrous oxide and ether. In a fairly large number, simple drop-ether, without a nitrous oxide induction, was administered. The patient who was very critically ill was operated upon usually under local novocaine anesthesia, particularly if only a short procedure, such as enterostomy, was contemplated. During the past few years we have been using spinal anesthesia almost routinely in acute ileus, frequently even in patients critically ill. The figures in Table II might indicate, at first glance, a definite superiority of general anesthesia over spinal. This advantage, however, is more apparent than real, since the spinal anes-

TABLE II

Anesthesia

Type	Number of Cases	Deaths	Mortality
General	146	43	29.4%
Spinal	31	12	38.7%
Local	23	14	60.8%

thesia group includes many patients who were decidedly poor risks and who, several years before, would probably have been operated upon under local anesthesia. Because of the diversity of factors which one must consider in interpreting these figures it is obviously impossible to draw any valid conclusions as to the relative merits of these anesthetic agents. We are partial towards spinal anesthesia because the perfect relaxation which it affords greatly facilitates exploration and because the danger of aspiration of regurgitated stomach contents is reduced to a minimum.

The actual operation in this series has varied from a simple ileostomy to a resection of many feet of intestine. We are now trying to do as little as is consistent with the welfare of the patient. Many cases which today are

being treated by simple enterostomy would probably have been subjected to a prolonged exploration a few years ago. Those showing bloody discoloration of the peritoneal exudate, of course, are always explored in an effort to locate the strangulated loop. When gangrene of the intestine is encountered, the correct procedure becomes a subject of considerable controversy. Our records show 28 instances of resection with 21 deaths, a mortality of 75 per cent. Of this group, 21 were primary resections with immediate anastomosis, and 7 were of the Mikulicz type. Following primary anastomosis there were 15 deaths (71.4 per cent). Six of these died within 12 hours after operation, presumably of operative shock superimposed upon a severe toxemia; 5 died of peritonitis within one week; the remaining 4 succumbed as a result of (1) pulmonary embolus; (2) cerebral hemorrhage; (3) inanition, following a high intestinal fistula; and (4) cardiac failure on the eighth day of an apparently smooth convalescence. Of the seven cases of exteriorization of the gangrenous loop, only one survived. Five of this group died within 24 hours after operation. The sixth death occurred on the fourth day, in a patient who seemed to be progressing satisfactorily, and was attributed to cardiac failure.

Deplorable as these figures may appear, they are reasonably consistent with those of many other institutions,[2, 4, 5, 11] and they lead one to question the desirability of primary resection in any case, however favorable the condition of the patient may appear to be. Resection of the small bowel in a patient who is not obstructed is not an unduly hazardous procedure, but in the presence of acute ileus the situation is quite the reverse. Resection requires a lengthy anesthesia in a patient who is already depleted; it involves prolonged manipulation of distended loops of intestine with the attendant surgical shock; and it necessitates a hasty anastomosis between two segments, one of which, already damaged by distention and ischemia, is certainly not an ideal tissue for suture. It would be more rational, it appears to me, to defer primary anastomosis in all cases in which resection is necessary. The gangrenous segment may be exteriorized, as in the Mikulicz procedure, with the establishment of an external fistula, which will serve adequately to decompress the obstructed intestine. The fistula may be closed later, with far less danger, in a subject who has become meanwhile more or less rehabilitated. It is true that in this series exteriorization was tried in seven instances with six deaths; but in these six cases it was not the procedure of choice. It was employed only because the patient was *in extremis* and obviously would not tolerate a primary resection.

We have had no experience as yet with the decompression of distended intestine by continuous suction with the duodenal tube as advocated by Wangensteen in acute adhesive obstruction.[8] In early postoperative nausea and vomiting, we have made frequent use of the small indwelling stomach tube, introduced through the nose, with intermittent aspiration, and we use it almost routinely in ileus associated with an early plastic peritonitis. We have no doubt that the use of the duodenal tube during the past two years

has obviated the necessity of an enterostomy in a good many instances. The efficacy of this method of decompression in early postoperative adhesive ileus has led, naturally, to its employment by some in the later cases of obstruction in which adhesions were suspected of being the etiologic agent. In fact, during the past year, several writers, notably Wangensteen[8] and Bartlett,[9] have advocated the use of the duodenal tube with continuous suction in nearly all cases of obstruction, early or late, in which obvious gross strangulation could be ruled out. While we appreciate fully the rationale of the use of the indwelling duodenal tube in appropriate cases, our past experiences with late adhesive obstruction compel us to recognize the possible tragic consequences of undue delay in the borderline case. As stated above, 43 per cent of our cases (excluding herniae) showed direct interference with the blood supply to the involved segment of intestine, with changes varying from marked discoloration to complete devitalization of the wall. In an analysis of a similar nature at the Massachusetts General Hospital, McIver found that 42 per cent of all cases (excluding herniae and neoplasms) showed interference with the mesenteric circulation.[4]

Quite frequently, in operating upon cases of supposedly simple occlusion, the surgeon finds a loop of intestine the blood supply of which has been seriously compromised. With prompt release of the constricted vessels, the normal color slowly returns into the apparently lifeless segment and within a few minutes it may safely be replaced within the abdomen. This type of obstruction, in which expeditious surgery has spared the patient a hazardous resection, is decidedly not an exception. On the contrary, the figures quoted above concerning the incidence of strangulation indicate that it is rather a common finding, and with this thought in mind we feel that the advantages of any unduly prolonged delay, pending the outcome of any palliative procedure, are indeed questionable. Were it possible before operation to differentiate positively between cases of simple obstruction and those complicated by strangulation of blood supply, the decision as to immediate operation or preliminary conservative measures would be easier to make. In view of the recognized difficulty of such a differentiation, however, and the relative frequency with which intra-abdominal strangulation is encountered, we feel that except in a few instances, delay is not justifiable. The exceptions I have in mind are those patients whose condition is extremely critical on admission; cases in which one questions the wisdom of operating at all and in which a futile enterostomy is usually performed. These cases almost invariably terminate fatally following any immediate surgical attack and they represent, in my opinion, a group in which prolonged delay, permitting the administration of salt and fluids and duodenal intubation, is justifiable and might conceivably increase the chances of survival. To temporize in acute intestinal obstruction is to assume a tremendous responsibility. In the absence of a positive diagnosis of simple, uncomplicated occlusion, one assumes the risk of seriously jeopardizing the chances of many patients who are in need of immediate relief.

CONCLUSIONS

(1) The administration of large quantities of salt solution preoperatively and postoperatively has had no appreciable effect on our mortality in acute intestinal obstruction.

(2) Resection of gangrenous intestine with primary anastomosis in a patient afflicted with acute intestinal obstruction is too hazardous a procedure. Exteriorization of the involved segment, as in the Mikulicz operation, involves less risk and should be done wherever feasible.

(3) In view of the frequency with which intra-abdominal strangulation is encountered and the difficulty of differentiating it from simple occlusion, any undue delay in operating is not justifiable. Conservative procedures, such as the prolonged administration of salt solution and duodenal intubation, however, are of distinct value in the simple obstruction associated with an early plastic peritonitis, and may be employed with possible advantage in the markedly advanced cases of acute ileus in which immediate surgical attack is too hazardous.

(4) In early diagnosis lies the chief hope for any significant reduction in mortality.

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DIASTASIC PERFORATION OF THE NORMAL CECUM

RESULTING FROM OBSTRUCTION OF THE COLON

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IN CERTAIN cases of obstruction of the large bowel, perforation of the uninvolved cecum culminates a chain of events which is of peculiar interest and not widely appreciated.

By "diastasic perforation" is meant a "blow-out" of the wall of the cecum caused by that overdistention which results from remote obstruction of the distal colon. In the five cases presented in this paper, the obstruction was caused by carcinoma in the descending portion of the large bowel.

It is commonly known that the cecum, or other portions of the colon, may perforate spontaneously at the site of disease, such as the ulcerations of typhoid fever, carcinoma, chronic ulcerative colitis, or tuberculosis, and perforations may be caused by foreign bodies or by volvulus. It is not generally realized, however, that overdistention alone may rupture the wall of an otherwise normal cecum.

Heschl,[14] in 1880, was apparently the first author to write on intestinal perforations proximal to an occlusion. He used the term "diastasic perforation." Since then, articles have appeared by Sauer,[15] Kraft,[16] Kreuter,[17] Schonleber[18] and Bertrand.[19] In 1902, Anschütz[1] read a paper devoted to this subject; he presented two case reports and also offered an hypothesis to explain why the cecum alone was involved.

In 1928, Riche and Guibal[2] described a perforation of the cecum immediately proximal to an annular carcinoma of the ascending colon. They, too, reviewed the various hypotheses to explain this clinical fact.

Various other authors, in discussing cancer or obstruction of the colon, have mentioned incidentally the possibility of such perforation. Among these, Hartwell,[3] in 1917, described a case discovered at operation and cited Passot's case[4] (1910). In 1922, Dickenson[5] reported two similar cases; Wrigley,[6] in 1933, and Rankin[7] in his text-book warned against a misinterpretation of pain on the right side which might lead to an erroneous diagnosis of appendicitis. In 1923, Burgess[8] cautioned that such a perforation might occur in the event of too long a delay in the treatment of chronic obstruction of the large bowel.

MECHANISM

There are numerous factors which might tend to cause the cecum, rather than other portions of the colon, to give way.

First, the cecal wall is thinner. It has been shown experimentally[9] that, when the large bowel is inflated with air or distended with water, in an attempt to dislodge a ligature from an appendectomy stump, the first rupture is

through the wall of the cecum at a point along its mesial aspect about two inches distal to the ileocecal valve.

Second, before a carcinoma causes complete obstruction, it usually produces partial obstruction for some time. This prolonged obstruction causes chronic distention and gradual hypertrophy of the wall of the bowel. The hypertrophy is greatest just proximal to the lesion, and gradually diminishes toward the cecum. Thus the cecum shows the least hypertrophy and hence is relatively weaker.

Third, the diameter of the cecum is greater than that of other parts of the colon. This factor alone can be shown by experiment to subject it to greater strain. Anschütz showed that, if a large and a small rubber balloon are attached to the arms of a "T" tube (Fig. 1) and water is pumped into the stem of the tube, the larger of the balloons will rupture first. The same physical conditions obtain in certain cases of obstruction of the bowel. The

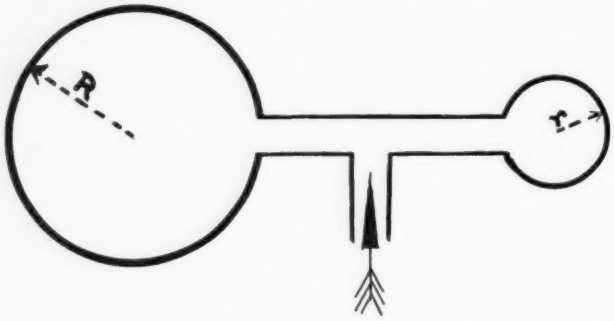

FIG. 1.—Illustrating the physical laws of force applied to balloons of unequal diameters, representing the cecum and the more distal colon.

bowel proximal to an obstruction is filled with fluid feces and gas; thus, according to Pascal's law, any pressure within it will be distributed equally in all directions. At times, a wave of peristalsis temporarily produces a greater pressure when there is an obstruction. This increased pressure may be withstood by the hypertrophied and stronger portions of the wall of the bowel, but may produce rupture of the greatly distended cecum. This same principle (that is, the rupture of the balloon) can be demonstrated mathematically.*

Fourth, it would seem that the ileocecal opening must be closed in order

* In a spherical balloon with elastic shell, there is a force exerted toward the plane of any diameter equal to $T \cdot 2\pi r$ equals $P \cdot \pi r^2$, or until P equals $\frac{2T}{r}$.

"Now, consider two spheres, one with a radius R and one with smaller radius r, communicating by a tube and containing gas under pressure, P. By Pascal's law, P is equal in the two spheres. But P equals $\frac{2T}{R}$ equals $\frac{2t}{r}$ where T and t are the tensions of the spherical bags of radius of R and r respectively. Thus, T is greater than t in the ratio of R to r. Thus, as the pressure is made to increase, the ratio $\frac{T}{t}$ remaining constant and equal to $\frac{R}{r}$, when $\frac{2T}{R}$ reaches the limit of tensile strength, $\frac{2t}{r}$ is still below that limit, and the membrane forming the larger sphere must rupture.

to localize the distention at the cecum. If this were not so, gas from the colon would pour constantly into the ileum and produce progressive distention up the small bowel with no particular strain on the cecal wall. It may be that lack of competence of the ileocecal valve makes diastasic perforation a relatively rare complication of colonic obstruction. Hertz[10] and Carman[11] were of the opinion that the function of the valve is not to prevent regurgitation from the cecum into the ileum. Carman[11] stated that, in the use of the routine barium enema, the enema passes back into the ileum in about 90 per cent of cases. If this is true, 10 per cent of patients with obstruction of the large bowel might develop diastasic perforation of the cecum.

Fifth, we noticed in two of our patients that the cecum alone was tremendously distended, and the transverse colon was collapsed, although the obstruction was situated at the splenic flexure. This led us at first to believe that the obstruction was at the hepatic flexure, but no lesion could be found in this region. Hirsch,[12] in 1922, pointed out a possible explanation of this apparent kinking of the hepatic flexure. He found evidence in human beings of a sphincteric tract situated between the cecum and the colon. Such a sphincter is seen in horses, birds, and other air-breathing vertebrates. In human beings, the vestiges of this sphincter may be demonstrated by a constriction seen fluoroscopically with the barium enema and also in hardened autopsy specimens.

He assumed that a sphincteric action might trap the excess gas so often seen in the cecum, and that this might cause painful overdistention and symptoms in the right lower quadrant.

It may be possible, therefore, in the two cases mentioned above, that much of the gas gradually accumulated and was held there between a competent ileocecal valve and the "cecocolic sphincteric tract," thus explaining why the transverse colon was not distended.

Before continuing the discussion of the mechanism of these perforations, one may ask whether any other pathologic process occurs immediately at the site of perforation. Upon this point our surgical experiences, as illustrated by the following case reports, throw some light.

CASE REPORTS

CASE I.—D. O., male, 38 years of age, entered the hospital with the complaint of abdominal cramps on the right side, constipation and vomiting for two days. One month before entry, he had similar cramps for a few hours. He then had been well until the present attack. The cramps of which he complained were gradually replaced by a steady pain in the right lower quadrant. Several times during the two days he vomited clear material, once after taking castor oil. He had lost no weight; there had been no change in bowel habits; nor was there a history of blood in the stools.

Physical Examination.—On entry his temperature was 99.6°F., and his pulse rate 100. He did not appear to be particularly ill. Examination was negative except for the abdomen. There was no distention. Tenderness and slight muscle spasm were present in the region of McBurney's point. The white blood count was 13,400, with 85 per cent polymorphonuclear cells. A diagnosis of subsiding appendicitis was made. Operation was advised but refused. On the afternoon of the second day he consented to operation.

At this time his temperature was 100.5°, and the pain, tenderness, and rigidity were much increased.

Operation.—A McBurney incision revealed a large amount of gas in the peritoneal cavity. The cecum was greatly distended and a loop of ileum was adherent to it. Between this loop and the cecum was a small abscess attached to the side of the appendix. When the appendix was removed it was found to be covered with fibrin but was not perforated. A right rectus incision was then made, and a generalized lower abdominal peritonitis discovered. The stomach and upper abdomen were normal. Two small perforations, each about 2 Mm. in diameter, were found on the mesial aspect of the cecum two inches above the ileocecal valve. Each was surrounded by a small necrotic area.

The cecum alone was distended. The transverse colon was collapsed. No lesion was found at the hepatic flexure. The two perforations were closed, and later a cecostomy was done. Microscopic sections of the appendix revealed subacute appendicitis with inflammatory infiltration of all of the coats. The patient recovered from his subsequent peritonitis. Further roentgenographic studies revealed an obstruction at the splenic flexure which proved, at a subsequent operation, to be an annular carcinoma.

Case II.—M. Q., female, 70 years of age, entered the hospital with the complaint of pain and soreness in the right lower quadrant. Her illness began one week before entry. At that time she had her last bowel movement. The next day she had moderately severe epigastric cramps, recurring at intervals of about 15 minutes, and the pain radiated into each flank. She became distended and was unable to pass either gas or fecal material in spite of the administration of castor oil and repeated enemata. There was no vomiting. During the last two days the cramps almost disappeared, to be replaced by steady pain and soreness in the right lower quadrant.

Physical Examination.—On entry, the abdomen was somewhat distended, the right side being more so than elsewhere. Rushes of peristaltic sounds could be heard. A diagnosis of colonic obstruction with imminent perforation of the cecum was made at entry but was disregarded because of the physical findings observed one and one-half hours later. At this time her temperature was 100.8° and her pulse 106. Her general condition was fair. There was slight orthopnea, with some evidence of chronic myocarditis, and a blood pressure of 155/80. The white blood count was 20,000, with 92 per cent polymorphonuclear cells. There was by this time moderate but symmetrical distention of the abdomen with marked tenderness, rebound tenderness, and rigidity in the right lower quadrant. There was also slight tenderness in the left lower quadrant and in the right side of the pelvic cul-de-sac. Peristalsis was neither visible nor audible. A diagnosis of acute appendicitis was made.

Operation.—Through a McBurney incision a large amount of gas and a small amount of brownish fluid were found in the peritoneal cavity. The appendix appeared normal. On the mesial side of the cecum three inches above the ileocecal valve were three ragged, dirty, necrotic perforations within an area one inch in diameter. Through these openings a small amount of liquid fecal material had spilled, without widespread contamination of the peritoneum. The proper presumptive diagnosis was then made without attempting general exploration of the abdominal cavity. A catheter was sutured into the perforations to serve as a cecostomy tube. The patient gradually recovered from the ensuing peritonitis. Two weeks later a barium enema demonstrated obstruction at the splenic flexure. The patient gradually lost strength and died three weeks after entry without further surgery.

At necropsy, an adenocarcinoma of the splenic flexure with marked constriction of the lumen was found. There were multiple small polyps of the colon. The cecum seemed normal except for the cecostomy opening. No peritonitis was evident. The patient died as the result of bilateral pyelonephritis, generalized arteriosclerosis and marked cachexia.

Case III.—B. B., male, aged 65 years, entered the hospital in very poor condition. He had had "stomach trouble" characterized by central abdominal pain and flatulence not

related to meals. This had become so severe that he had been forced to discontinue work 16 months before. He had always required cathartics, but had become more constipated. He had lost much weight in the past few months. One week before entry he became much weaker, pains became constant and more severe, he began to vomit frequently, and the vomitus gradually became darker. Later his abdomen became distended and for two days he had been unable to pass gas or fecal material.

Physical Examination.—Examination revealed a very weak, emaciated old man with generalized arteriosclerosis, large bilateral supraclavicular nodes, and a foul breath. The heart sounds were weak, and the blood pressure 142/80. The lungs seemed normal. The abdomen was generally tender, rigid, and markedly distended. His temperature was 97.8°, pulse 160. Hemoglobin was 78 per cent, white blood cells 16,900; urine negative. The stool contained no occult blood. The diagnosis was inoperable carcinoma of the stomach. Repeated enemata produced poor results. He gradually became stuporous and expired one week after entry.

At necropsy the peritoneal cavity was found to be filled with fecal material and gas which were coming from a perforation of the cecum, the location of which was not described. There was an annular adenocarcinoma obstructing the sigmoid four inches above the rectosigmoidal juncture. There were numerous metastases in the liver and lungs.

Case IV.—H. J., male, 75 years of age, entered the hospital in very poor condition. He had always been constipated. Aside from the loss of 25 pounds in the previous three years, he said that he had been perfectly well. His constipation had become more severe during the past six months and had been complete for five days. Three weeks before entry a vague pain appeared in the lower part of the abdomen which had become distended. He had no periodic cramps or vomiting.

Physical Examination.—His heart was fibrillating; blood pressure 130/80. There were a few râles at the base of each lung. The abdomen was tremendously distended, being more marked in the right lower quadrant. He was thought to have carcinoma obstructing the large bowel. The next day he was operated upon with the diagnosis of peritonitis.

Operation.—The abdomen was opened on the left side through a McBurney incision. There was a large amount of gas in the peritoneal cavity. A large annular mass was found in the sigmoid at the pelvic brim, and a colostomy was made proximal to the tumor. A low midline incision revealed a longitudinal tear about 5 cm. long in the anterior taenia of the cecum, extending through the muscularis; the mucosa, which was perforated in two places, was cyanotic and necrotic. The entire length of the large and small bowel was collapsed and covered with fibrin. The mass in the sigmoid appeared to be carcinomatous. It was fixed to the pelvic brim by extensive glandular metastases. A cecostomy was performed. The patient was in poor condition, dying 24 hours later of general peritonitis. Necropsy was not permitted.

Case V.—(Referred by Dr. Herbert Allen.) A. S., female, 53 years of age, was entirely well until ten days before admission, when she began to vomit everything eaten. This was severe and persistent, causing her to lose weight and strength. During the previous five days there was marked constipation, relieved only by catharsis and frequent enemata. The abdomen became progressively distended. No history was obtained of abdominal pain, probably because the woman was *in extremis* when she was admitted.

Physical Examination.—The patient was a large white woman and very dyspneic. The lips were cyanotic, tongue coated, temperature 104.9°, pulse 148, respiration 44. There were dull areas, bronchovesicular breathing, and crepitant râles at the bases of both lungs. The abdomen was enormously distended, tympanitic throughout, with no shifting dulness, no visible peristalsis, and no increase in borborygmus. There was no tenderness or rigidity. The clinical diagnosis was intestinal obstruction and bronchopneumonia. Because of her very poor condition, no operation was attempted.

At necropsy a carcinoma of the left ovary was found completely obstructing the adjacent sigmoid. This lesion had ulcerated through the sigmoid, producing a localized

abscess. There was also a necrotic perforation along the inner side of the cecum, through which fecal material had spilled into the general peritoneal cavity. There were metastases to the liver and lungs, and terminal bronchopneumonia.

We have had two other cases which are not included in this series because the patients were operated upon before perforation had actually occurred. One had a carcinoma of the splenic flexure with a tremendously distended cecum showing necrotic areas. In the other case, a carcinoma of the recto-sigmoidal juncture had caused tremendous distention and gangrene of the cecum.

We may speculate upon the exact pathologic changes occurring at the site of perforation. In one of the foregoing cases (Case IV) there was an obvious tear as if by mechanical violence. Such a tear is very rarely described in the cases reported in the literature. Most of the perforations have been obviously necrotic.

It is commonly known that distention of any segment of the bowel ultimately jeopardizes its blood supply, as pointed out by Van Buren,[13] in 1926. Its circumference is enlarged three times as fast as the diameter, so that the encircling vessels are subject to excessive stretching. This not only narrows the vessel (just as a rubber tube is narrowed by stretching) but the vascular lumen is also collapsed by pressure from within. In all parts of the bowel the area of poorest blood supply is along the antimesenteric border, represented in the cecum by the anterior taenia. If these cecal perforations were to occur because of necrosis through an avascular area, they should occur along the anterior edge. In our cases, with the exception of the patient who had the mechanical tear, this was not true. Experimentally and clinically, the medial aspect just above the ileocecal valve seems to be the weakest spot. In this particular area the blood supply is especially good.

Many observers consider that the perforations are secondary to preexisting, acute, toxic or infectious ulcerations having their origin in the mucous membrane and that these ulcerations in many instances occur on a vascular basis. The multiplicity of perforations in two of our cases lends strength to this view. Unless there was coexistent vascular or toxic injury, the first perforation might be expected to decompress the bowel sufficiently to prevent the development of others.

We have concluded that some vascular impairment on an infectious process precedes the perforation in most instances. The medial wall usually is perforated because it is probably mechanically weaker[9] than other portions.

SUMMARY AND CONCLUSIONS

(1) Distention of the colon secondary to an obstruction of the distal portion may produce a spontaneous perforation of the cecum.

(2) The factors which contribute to this phenomenon are enumerated.

(3) In the presence of obstruction of the large bowel, the danger of such perforation makes prolonged conservative treatment unsafe.

(4) The localization of signs and symptoms in the right side of the abdomen may lead to an erroneous diagnosis of appendicitis.

(5) A rational therapeutic measure when such a complication is threatened would be a temporary cecostomy.

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HERNIORRHAPHY USING A LIVING FASCIAL FLAP*†

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The occurrence of unsatisfactory results in inguinal herniorrhaphy has led many surgeons from time to time to suggest other technics. Basically, however, the classical Bassini operation forms the foundation of the majority of the new procedures. The operation to be described has been employed by us since 1929 in cases of recurrent hernia or of primary hernia in which the usual procedures were not considered adequate.

The failures in the classical inguinal herniorrhaphy have been ascribed to suture of conjoined tendon and inguinal ligament under tension; the suture of heterogeneous tissues; the use of foreign suture material; the unsatisfactory treatment of the sac and the insecure closure of the lower angle of the conjoined tendon, or inguinal ligament line of closure.

Hodgkins[2] gives an excellent review of the literature and discusses thoroughly the various methods of herniorrhaphy utilized. He concludes that Gallie and Le Mesurier[3] have made the most important contributions with the use of the "living suture" of fascia lata.

Hodgkins,[2] working on the premise that a method of suturing which will hold the muscle and aponeurosis unyieldingly and permanently in place is the best type, evolved the operation of fascial weaving. "The living fascial sutures are fashioned from parallel transverse incisions $\frac{5}{16}$ inch apart on the rectus sheath, beginning at the lateral border of the opposite muscle and ending at the lateral border of the muscle on the side to be repaired. Each of the three or four strips is woven into place as a suture before another is cut and the sutures introduced as in the Gallie technic."

Kirschner[2] early used full transplants of living fascia lata to reinforce the suture line of the external oblique aponeurosis. This, as pointed out by many writers, proved of little advantage in herniorrhaphy. In 1922 and 1932, Gallie[4] described a method of closing very large hernial openings by the use of a many-tailed fascial sheet. He observes that in inguinal hernia the need for the many-tailed fascial sheet is not great, and limits its use to cases in which the abdominal defect is very large.

We have used free fascia lata transplants to repair a defect between rectus sheath and conjoined tendon above and inguinal ligament below with surprising success. The wound healed by first intention and a firm posterior inguinal canal wall was formed.

The anatomical relations of the iliotibial tract of the fascia lata to the

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region of inguinal hernia led us to suggest its utilization in herniorrhaphy to eliminate the three cardinal objections to the Bassini operation named above.

The tractus iliotibialis forms the superficial covering of the tensor fascia lata muscle and is attached proximally to the external lip of the crest of the ilium and distally to the lateral condyle of the tibia and to the head of the fibula. The fascia is about two to three millimetres in thickness, and of exceptional tensile strength. An adequate wedge-shaped flap from the iliotibial tract with its base attached to the crest of the ilium is fashioned and passed underneath a small rent in the attachments of the external oblique attachments to the crest of the ilium and thus placed in the field of hernial repair superficial to the conjoined tendon and inguinal ligament, superior to the internal abdominal ring and deep to the aponeurosis of the external oblique. By suturing this flap to the rectus sheath above and to the conjoined tendon and inguinal ligament below, one obtains a permanent unyielding fascia to fascia union and a markedly reinforced inguinal canal wall.

Operative Technic.—All patients received at least three days of bed rest with general hygienic treatment and preparation of operative area. The preparations consist of shaving and scrubbing with green soap and painting with alcohol and ether and the application of a sterile dressing. The antiseptic preparation and sterile dressings were repeated daily until the time of operation. A sand bag, about four inches in thickness, is placed under the buttock on the side to be operated upon. This places the area from which the fascial flap is to be fashioned in the most accessible position.

The first stage of the operation up to and including the treatment of the sac is the same as in the Bassini technic. The inguinal incision in Fig. 1 represents this stage. An artery clamp is introduced in the upper angle underneath the external oblique aponeurosis and directed toward its attachment to the crest of the ilium at a point one inch lateral to the anterior superior spine. A moist abdominal pad is then placed in the inguinal operative area and the flap of fascia lata fashioned.

The incision in the thigh (Fig. 1) extends from a point one inch lateral to the anterior spine and directly over the centre of the greater trochanter of the femur. The length of the incision as well as the length of the fascial flap is determined by measuring the distance from the anterior superior spine to the pubic tubercle and adding one and one-half inches. The incision is made through skin with identification of the deep fascia. This is divided longitudinally, exposing the superficial layer of the tensor fascia lata.

The apex of the flap should be one inch in width and its base one and one-half inches at the level of its attachment to the crest of the ilium. Thus a wedge-shaped flap of fascia lata is fashioned. The clamp is passed over the crest of the ilium, tearing a rent one and one-half inches wide in the attachment of the external oblique to the crest of the ilium and in the region at the base of the fascial flap. The fascial flap is then easily passed into the inguinal canal (Fig. 2).

The incision in the thigh is now closed after meticulous hæmostasis (Fig. 4). The deep fascia is repaired by a continuous running No. 2 chromic single suture. A rubber dam drain is placed deep to this fascia and protruding at the lower angle of the wound, to prevent formation of

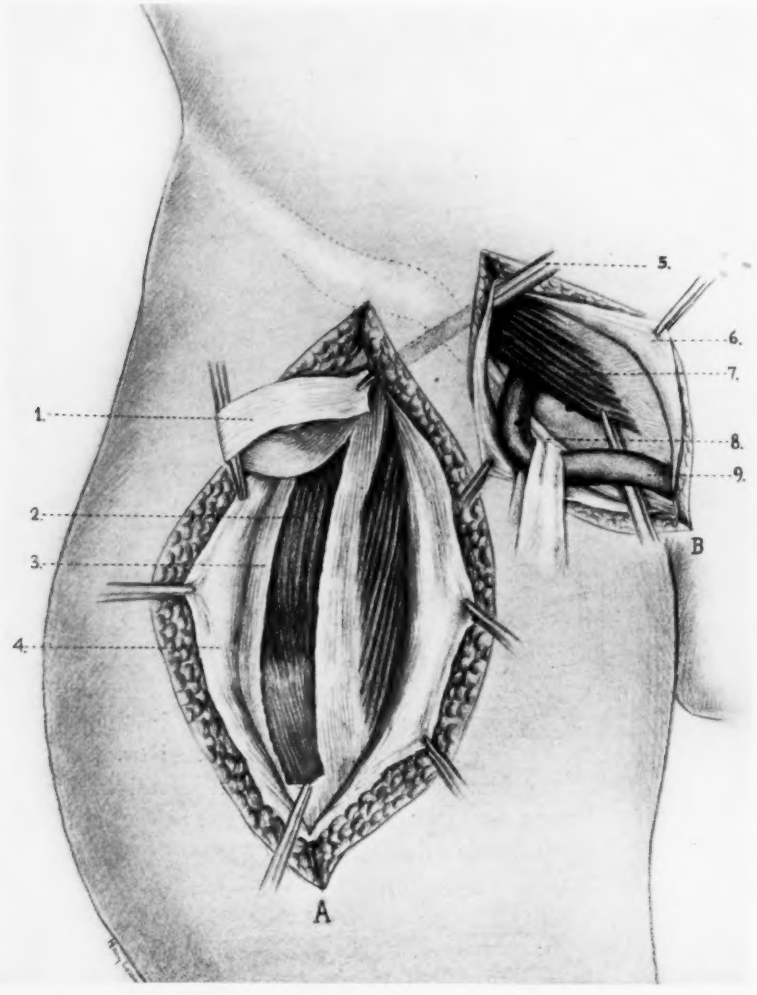


FIG. 1.—(A)—Incision in thigh, showing preparation of fascial flap. (B)—Inguinal herniotomy up to and including treatment of sac. 1.—Flap of tensor fascia lata. 2.—Tensor fascia lata muscle. 3.—Tensor fascia lata. 4.—Deep fascia of thigh. 5.—Clamp underneath external oblique. 6.—External oblique aponeurosis. 7.—Conjoined tendon. 8.—Reflected edge of the inguinal ligament. 9.—Spermatic cord.

hæmatoma and to avoid fascial infection. The skin is repaired by silkworm-retention sutures and Michel clips.

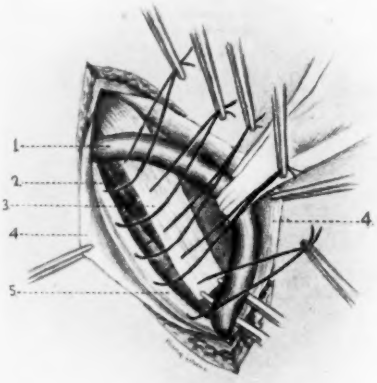
The lower border of the fascial flap is sutured above and below the cord at its exit from the internal abdominal ring (Fig. 2) to the inguinal ligament and pubic spine by interrupted No. 3 chromic sutures (Fig. 3). If the conjoined tendon is accessible and adequate enough to reach the in-

guinal ligament it is also included in the sutures passed through the lower border of the fascial flap. This latter is recommended but is not a necessity.

The upper border of the fascial flap is sutured by No. 2 chromic interrupted sutures to the rectus sheath (Fig. 4). If the rectus sheath lies too far medially to be included in this suture, an incision is made in the sheath so that its free edge can be used for suture to the upper border of the fascial flap.

The external oblique aponeurosis is repaired underneath the cord (Fig. 4), using running No. 2 chromic single. The skin is repaired with silkworm-gut sutures and clips. We have drained all our cases, and recommend this procedure. Patients are confined to bed for three weeks with rest for six to eight weeks thereafter before resuming their occupation.

Discussion.—Hodgkins[2] states that from a histological standpoint the



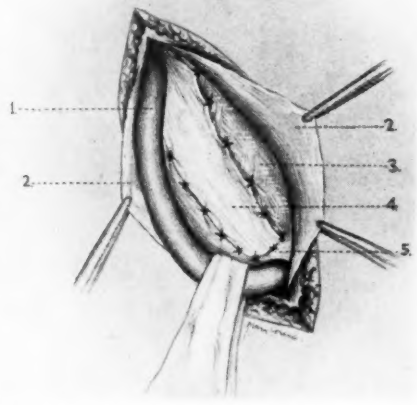


Fig. 2.—Flap of fascia lata being sutured in place. Suturing of lower edge including conjoined tendon to inguinal ligament. 1.—Spermatic. 2.—Conjoined tendon. 3.—Flap of tensor fascia lata. 4.—External oblique aponeurosis. 5.—Inguinal ligament.

Fig. 3.—Flap of fascia lata completely sutured in place, lower edge to inguinal ligament, apex to pubic tubercle and inguinal ligament and upper edge to rectus sheath.

surgical principle of suture is absurd because the recurrent cases show that the muscle has pulled away and returned to normal position so that at the most only a few strands of fibrous tissue are left to represent what was evidently a carefully done repair. While it is true that this consistent finding proves the inefficiency of foreign suture material in muscle under the tension and pressure of tying, it does not disprove its efficiency when the tension is released before placing the sutures by incising the rectus sheath longitudinally. There is no difference, to our minds, if tension is present as to whether homogeneous or heterogeneous sutures are used, recurrences will occur anyway.

The absence of union (Chauke, 1923) or limited union of the fascia muscle repair (Kuntz, 1927) led Gallie and Le Mesurier to use living fascial sutures and Hodgkins to use living fascial weaving. The success of this

type of operation is dependent not only upon the living *in situ* fascial sutures, but the release of tension in the conjoined tendon by incisions in rectus sheath and the imbricating of the aponeurosis of the external oblique.

The procedure of transplanting the stump of the sac under the conjoined tendon or in a rent in the conjoined tendon is a step forward towards proper fixation of the sac. This, however, does not give assurance that the sac is completely taken care of, because one often sees a sac recurring in

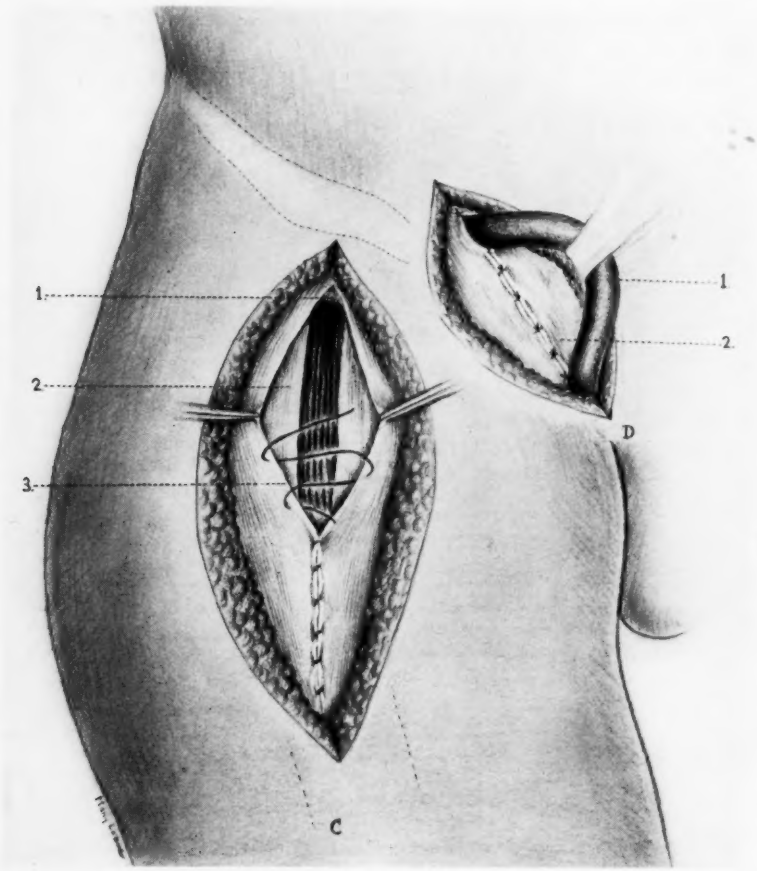


FIG. 4.—(C)—Repair of incision in thigh. (D)—Repair of external oblique aponeurosis underneath the cord. 1.—Base of transplanted flap of fascia lata. 2.—Tensor fascia lata. 3.—Repair of deep fascia. (D-1)—Cord. (D-2)—External oblique aponeurosis.

the lower angle of the herniorrhaphy after it has been treated as above described. The medial portion of an indirect sac is in direct communication with the peritoneum and the transversalis fascia medial to the deep epigastric vessels, this being the area through which direct hernia arises. In almost all types of indirect hernia one finds a flaccidity of the peritoneum and therefore to properly treat the sac this slack must be taken up by blunt dis-

section before the base of the sac is transfixed and transplanted under or through the conjoined tendon.

If the sac is so treated, recurrence at the angle formed by the pubic spine, conjoined tendon and inguinal ligament is unlikely. To overcome any possibility, however, proper suture through the periosteal fascial covering of the pubic spine, conjoined tendon and inguinal ligament at that angle will offer the best means of preventing recurrence at that point.

The transversalis fascia forms a dilated ring around the deep epigastric vessels and Downes[1] has suggested picking up this ring with Allis clamps and placing a continuous row of chromic catgut No. 2 sutures to close that angle. This further prevents recurrence at the internal abdominal ring.

In the present suggested operation all objection seems to be removed in that an added living fascial wall is used. There is a fascia-to-fascia approximation and therefore it is not necessary to use living fascial sutures, although they can readily be fashioned and used. While this technic may offer a good protection against recurrency, it is an ideal procedure in recurrent herniæ. In recurrent herniæ the transplanting of the cord under the skin is an added recommendation so as to allow complete fascia to fascia healing.

CONCLUSIONS

(1) For recurrent herniæ the above method seems to be an adequate and safe procedure even on the most difficult cases.

(2) While the above method is excellent for the ordinary simple hernia, we do not believe it should replace the present methods of treatment.

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APPENDICES FOUND AS CONTENTS OF FEMORAL HERNIÆ

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In a review of femoral herniæ at Detroit Receiving Hospital, two cases were found in which the femoral contents consisted of appendices. A similar case was found at Detroit Grace Hospital. These cases prompted an analysis of all the femoral herniæ encountered at both the hospitals mentioned, from 1927 to 1933. Some interesting facts regarding the contents of these herniæ were revealed, and because of the rare occurrence of the vermiform appendix being in the sac, particular interest was centred on the three cases mentioned above. The analysis was made as to distribution, age and location. Particular attention was paid to the contents of these herniæ.

Of the ninety-seven cases in this series, sixty-eight were found at Receiving Hospital and twenty-nine at Grace Hospital. As to the difference in sex distribution, at Receiving Hospital there was none, thirty-five occurring in the males and thirty-three in the females; at Grace Hospital there was a greater variation, only eight occurred in males and twenty-one in females. Watson[1] states that at Mt. Sinai Hospital in New York femoral herniæ occurred four times more frequently in the female than in the male.

As to age, it was found that the youngest case was a patient nineteen years old; the oldest patient was seventy-seven years old. The average age at which the patient presented himself in the hospital was forty-seven years.

It was noted that sixty-two of the herniæ occurred through the right and forty-two through the left femoral opening. Only three cases had bilateral herniæ. These figures vary somewhat from those of Berger,[2] who quotes the incidence of bilateral herniæ as 20 per cent. of all femoral herniæ. However, it is possible that in our series of cases there were many cases of bilateral herniæ that were not noted, because the predominant pathology was on one side.

Table I

	Receiving Hospital	Grace Hospital	Total
NUMBER	68	29	97
Sex			
Male	35	8	43
Female	33	21	54
Side			
Right	43	19	62
Left	22	10	32
Bilateral	3		3

TABLE I *Continued*

	Receiving Hospital	Grace Hospital	Total
Age			
Youngest	19	25	19
Oldest	77	74	77
Average	47	45	47

Forty-two of the femoral herniæ in this series contained abdominal viscera. It is significant that of this group 40 were either strangulated or incarcerated. The largest single group involved small intestine as the contents of the sac; there were eighteen such cases. Thirteen cases contained omentum alone. Six cases contained intestine plus omentum and two cases contained bladder.

In our series, strangulation and incarceration of femoral contents were grouped as one. This group comprised 41 per cent. of the cases studied. The series studied at Mt. Sinai Hospital involved strangulation in 26 to 32 per cent. of the cases.

TABLE II

	Receiving Hospital	Grace Hospital	Total
Containing viscera	29	13	42
Strangulated or incarcerated	29	11	40
Appendices	2	1	3
Omentum	7	6	13
Omentum and intestine	4	2	6
Intestine	16	2	18
Bladder	0	2 (not incarcerated)	2

As to results, the problem became more difficult. The cases were handled and operated on by a number of different surgeons. Evaluation of operative procedures and results would be impossible. However, in this group, eighty-three of the ninety-seven cases were discharged as improved. Six had doubtful or unrecorded results. There were eight mortalities. Of this last group, two had refused operation. Of the remaining six cases, four were late obstructive cases, and because of the gangrenous condition of the bowel, had required intestinal resection. Two cases developed pulmonary complications, from which they died. All of these were late cases.

CASE I.—Patient R. C., white female, aged forty-eight years, was admitted to Detroit Receiving Hospital November 7, 1932, complaining of a painful mass in the right inguinal region. Patient stated that she had had a reducible mass in the right inguinal region for many years. Six days before admission it again appeared but she could not reduce it. She vomited the first day only. Patient was able to go about her work although the mass was growing gradually larger and becoming more painful. On admission patient did not appear acutely ill. Temperature was 99.6°, pulse 80, respirations 20.

On physical examination a reddened, tender, fluctuant mass was noted in the right groin over the middle of Poupart's ligament. The abdomen was soft. There were no areas of tenderness and no palpable masses in the abdomen. No spasticity or rigidity.

The mass was approximately the size of a walnut. The analysis of the blood showed: hæmoglobin 13.2 grams; red cells 4,120,000; white cells 10,350; the differential white count showed polymorphonuclears 86 per cent.; large mononuclears 2 per cent.; small mononuclears 12 per cent. The urine was normal.

A pre-operative diagnosis of an incarcerated femoral hernia containing omentum was made. Immediate operation was deemed advisable. At operation, the mass in the right groin was found to consist of a peritoneal sac containing necrotic material and a black necrotic appendix. The tip of the cæcum was also involved in an inflammatory reaction. The appendix was reduced bimanually through the femoral opening and removed from the abdomen in the usual manner. The femoral opening was closed and a herniorrhaphy was performed, with drainage of the peritoneal cavity provided for at the lower end of the incision. Apparently, the appendix, after passing through the femoral opening, had pointed back over Poupart's ligament, had become strangulated, necrotic and formed an abscess.

The pathological diagnosis on microscopical examination was severe subacute appendicitis, peritonitis, and omentitis. Clinical diagnosis of strangulated femoral hernia with an acute appendicitis and abscess formation was made. Patient's post-operative course in the hospital was uneventful and she was discharged in an improved condition with the incision well healed.

CASE II.—Patient G. C., white female, aged forty-one years, was admitted to Detroit Receiving Hospital on March 11, 1932, complaining of a painful tumor mass on the right side. She stated that she had had intermittent pain in the right inguinal region for the previous four years. During the last year she had noticed a mass in this region. This was not tender and was always reducible. Two weeks before admission the mass in the right groin again appeared but could not be reduced. This mass was tender. Patient had not vomited and bowels had been moving normally.

The examination of the blood showed: hæmoglobin 80 per cent.; red cells 4,200,000; white cells 16,200. The differential count revealed polymorphonuclears 84 per cent.; lymphocytes 16 per cent.

A pre-operative diagnosis of incarcerated right femoral hernia was made. Immediate operation was deemed necessary. At operation an incarcerated femoral hernia was found. When the hernial sac was opened, it was found to contain cæcum and a long appendix showing severe chronic inflammation. The appendix was removed in the usual manner and the hernia was then repaired.

The pathological diagnosis on microscopical examination was severe chronic appendicitis and peritonitis. The patient's post-operative course in the hospital was uneventful and patient was discharged in good condition.

CASE III.—White female, forty-seven years of age, was admitted to Grace Hospital January 26, 1933, with chief complaint of "rupture." By kind permission of Dr. Frank A. Kelly we are able to present this case.

Patient stated she had had the hernia for twelve years and that it had become larger of late. The blood cytology and other laboratory work was essentially unimportant. The patient's femoral hernia on the right side was repaired and it was found to contain a chronically inflamed appendix which was removed in the usual manner.

The patient's post-operative course was uneventful and she was discharged improved.

Pathological report: The appendix showed fibrosis of the entire wall with small round cell infiltration throughout. Diagnosis.—Chronic appendicitis.

Comment.—Of particular interest in this series were the three cases involving the presence of the appendix in the femoral sac: in one instance the appendix was actually strangulated and had become gangrenous. In the latter case, the appendix, after passing through the femoral opening had been

strangulated, became gangrenous, sloughed from the cæcum and formed an abscess below Poupart's ligament.

SUMMARY.—(1) A series of ninety-seven femoral herniæ are reported and analyzed, particularly as to their contents.

(2) The vermiform appendix was present in the sac in three of these cases.

(3) One of the contained appendices was strangulated and gangrenous. This was probably due to strangulation at the femoral ring.

(4) All three cases containing the vermiform appendix in the femoral sac were operated upon and recovered.

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TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING HELD MAY 7, 1934

The President, Dr. Walter E. Lee, in the Chair

Calvin M. Smyth, Jr., M.D., Recorder

MALIGNANCY OF THE THYROID

Dr. Thomas A. Shallow, Dr. William T. Lemmon, and, by invitation, Dr. Eli Saleeby read a paper with the above title for which see page 1190.

Dr. Charles H. Frazier recalled that about 25 years ago Howard J. Kelly gave us the first demonstration of the effect of radium on malignant tumors. One of his patients had an enormous sarcoma of the neck and he demonstrated the effects of radium treatment 10 and 14 days afterwards. The tumor had disappeared, and more than once the speaker has been reminded of that illustration of the effect of radium on malignant thyroid tumors. In some cases which seemed utterly hopeless the tumors disappeared under the influence of the roentgen ray. Recently a woman in her seventieth year with marked cyanosis and respiratory distress, due to a thyroid cancer that had all the earmarks of an inoperable tumor, was subjected to radiotherapy and in the course of two weeks there was not a vestige of tumor which could be felt.

END-RESULTS OF THYROID SURGERY

Dr. Charles H. Frazier and, by invitation, Dr. Julian Johnson read a paper with the above title for which see page 1195.

Dr. Charles H. Frazier supplemented his paper by saying that the end-results are not always dependent upon or related to the manner of execution of a particular operation. If one operates too late, no matter how well the operation be performed exophthalmos will persist. In two consecutive cases, though leaving the same amount of thyroid tissue, one may show signs of hypothyroidism and one may not. One-half grain or one grain of thyroid extract may be necessary to restore the patient's thyroid balance. We should not tax ourselves for the results of visceral damage in those patients who before the operation had damage of the heart, liver or kidneys.

Two figures in the statistical table presented are of practical interest. One supplies the answer to the questions one always must be prepared for: Will the goiter return? Will a second operation be necessary? For the five years preceding 1929 his records showed that there were relapses in three per cent of cases. In the last five years the records were better; according to Doctor Johnson's survey secondary operations were recommended in only 1.7 per cent. The second question which one must be prepared to answer definitely

and unequivocably is: What is the risk of operation? At one time he told his patients that his mortality rate was 1.5 per cent. The mortality has been reduced to 0.6 per cent. This is not because of improvement in technic, although many refinements have been made. Rather is it because of a better understanding of the preparation of the patients and certainly a more intelligent program for the postoperative care. The speaker wished to emphasize all Doctor Johnson had said as to the importance of carbohydrate metabolism in relation to hyperthyroidism. One can never be master of the hyperthyroid problem until he understands this relationship. Continued clinical observations supplemented by the important researches of Dr. W. D. Frazier have demonstrated this. In the speaker's opinion it has been the judicious use of glucose in the postoperative management of very toxic cases that has reduced the mortality to its present very low rate. He confessed that he is receiving cases today much sooner than he did five and ten years ago; he does not see so many gravely ill patients as he used to. Only ten patients were declined for operation in the past five years.

TUMORS OF THE PARATHYROID AND ASSOCIATED BONE PATHOLOGY

Dr. Thomas A. Shallow presented six cases in substantiation of an hypothesis that the assumption that hyperparathyroidism plays the principal rôle in the production of cystic disease of the bone is not to be made without due consideration of the other theories advanced as to its etiology.

CASE PRESENTATIONS

Case I.—A child with osteomalacia and osteitis fibrosa cystica, normal blood calcium and no operation.

Case II.—Normal parathyroid removed at operation in the presence of hypercalcemia in an individual with giant cell tumor and osteitis fibrosa cystica.

Case III.—A simple adenoma of the parathyroid gland showing no bone pathology.

Case IV.—A toxic adenoma of the parathyroid showing multiple cysts and multiple fractures.

Case V.—Toxic adenoma of the parathyroid, showing multiple giant cell tumors, multiple cysts and Paget's disease.

Case VI.—Giant cell tumor with no parathyroid tumor but hypercalcemia and low phosphorus.

While trauma has been suggested as a theory in the production of this disorder, definite traumatism has not been constantly demonstrated. However, since these cysts begin near the epiphysial area, where the ligaments and tendons are attached, then an individual could have a twist and produce sufficient truma to cause an hemorrhage in that area. This is not a new theory at all, but it is an accepted one in causing a traumatism which produces osteomyelitis. A second theory advanced by Geschicter and Copeland is that there is an hyperplasia of the osteoblasts. There is no doubt from the extensive work done by these authorities that this pathology does exist. Is it not, however, a reparative process in decalcification and not a distinct entity?

Concerning the theory of inflammation and infection, while it has not

been entirely discredited, it has not been demonstrated that it holds a very substantial place in the production of this disorder. Lastly, the metabolic theory of the origin must be approached on a broad basis. If we accept the common belief that bone cysts, osteitis fibrosa cystica, osteomalacia, osteoporosis and giant cell tumors belong in the same pathologic classification, then the problem narrows itself down to an endocrine basis as to the etiology of these disorders.

While it is true that the alteration in blood calcium and blood phosphorus is not a constant manifestation, yet we know that where there exists hypercalcemia and low phosphorus, these pathologic bone changes are constantly found. It is our belief that the parathyroid gland undergoes periods of cyclic activity in much the same manner as is observed in thyroid gland activity. That is, hyperplasia to normal or tumor formation, or even to hypoplasia, depending upon the period of activity whether we find a normal calcium and phosphorus or an abnormal blood chemistry.

There is a sufficient number of reported cases to show that cystic disease of the bone is present in the presence of normal parathyroid glands; likewise, there is a sufficient number of cases on record in which hyperplasia of the parathyroid gland has been observed. While no one questions the diagnosis in the presence of a tumor of the parathyroid gland, yet one of our patients and a patient reported before the New York Surgical Society (McConnell) showed the presence of a parathyroid tumor with no bone pathology or abnormal blood findings. These tumors should be considered as simple adenoma because of their pathologic picture which differs from the toxic adenoma. In the toxic adenoma, there is a difference in pathology and in the blood findings. If we are to believe that the parathyroid gland plays the principal rôle in the production of this disorder and that the parathyroid gland can undergo various pathologic manifestations, even to hypoplasia, then it is conceivable that we may observe the various bone manifestations due to parathyroid hyperactivity in the active stage and when the storm has passed, the individual could have tetany.

Do we give sufficient consideration as to why Nature has separated the parathyroid glands, as she has? Is it not conceivable that Nature realizing the instability of this structure has separated the units so that during pathologic manifestations one or two parathyroid glands might be affected and the remaining parathyroids carry on normal activity? Could this not also explain the absence of etiologic finding in the parathyroid glands in the presence of active bone disorder? Is it not remarkable that with the removal of the toxic parathyroid adenoma, the individual makes a rapid recovery from the disease as exemplified in Case IV of this series, the remaining parathyroids taking on the work?

TOTAL THYROIDECTOMY FOR CARDIAC FAILURE

Dr. Charles C. Wolferth, by invitation, in considering the medical aspects of the thyroid cardiac felt that the whole subject of total ablation of

the thyroid gland for congestive heart failure was in an experimental stage at present. One of the most important points is care in the selection of cases. It must be the function of the medical man to give the surgeon the right cases to operate upon. What are the right kinds of cases? As time goes on, and experience accumulates, our thoughts in this direction may be modified. At present the speaker feels that it is not worthwhile to do this operation in patients who have severe heart failure which will not respond to medical treatment. If a patient is continually getting worse under medical treatment, accumulates more and more fluid, so that one despairs of the result, it is natural to turn to surgery as a possible avenue of escape. This was done in the early stages of the work and while they were fortunate enough to escape operative mortality they did not accomplish anything worthwhile. The ideal patient for operation is one who is in a stationary or slowly progressive condition. On activity he may develop congestive heart failure, but on adequate rest, digitalization and other orthodox procedures, will get better or recover from the failure entirely. It is a great mistake to operate on patients whose condition is rapidly progressive. This would, of course, exclude from operation practically all patients with syphilitic heart disease. Only the very exceptional arrested case of syphilis should be considered for this operation. Patients should not be operated upon who have a reasonable chance of recovering under medical treatment. This operation changes the appearance of the patient. The skin becomes thick and young women who were attractive look many years older. There is a change in mental keenness and possibly subtle changes in emotional makeup, concerning which we know little at this time.

If the surgeon has not been successful in taking out the gland completely the basal metabolic rate will not fall as far as desired. A patient totally deprived of thyroid tends to have a basal metabolism of around minus 40. The operation should not be done on patients with a low basal metabolic rate. If one starts with a patient whose basal rate is minus 20, not much can be expected from operation. The rate cannot be permitted to fall below minus 30 because of the mental and physical retardation. Thus there is only a small margin to work on.

In the management of these patients all possible precautions should be observed. They are obviously not good risks and a certain mortality is inevitable. The essentials of a successful operation include removal of every vestige of thyroid tissue, preservation of the parathyroids and avoidance of bilateral paralysis of the vocal cords.

Doctor Wolferth emphasized the desirability of these patients remaining in bed until the basal rate is minus 20, or until it has been demonstrated that the rate is not going to fall that far due to incomplete removal. They feel better after operation as has been emphasized by Doctor Blumgart and his colleagues, and are optimistic. Some have died because they have not properly controlled their activities and not increased them gradually and cautiously.

Certainly this operation has a definite place in the treatment of congestive

heart failure but how large a place, the speaker was not prepared to say. The operation is hazardous but there is a group of patients to whom we have nothing else to offer as a constructive method of treatment. If operation is done carefully, adequate safeguards taken, and the proper type of case selected, our experience on the whole will not be unsatisfactory.

Dr. I. S. Ravdin in discussing the immediate results of complete thyroid ablation for congestive heart failure, said that nine patients had been operated on by Doctor Frazier and himself, with no operative deaths. As experience with this procedure had increased they felt that the operation should give a variable measure of relief in those patients with congestive failure who develop compensation on rest in bed. Patients who even after prolonged rest fail to develop compensation are poor subjects for operation, not only from the standpoint of the risk involved but from the end-result which may be expected. The relief from pain, especially that of an anginal character, is encouraging and it is likely that angina rather than congestive failure may prove to be the major indication for the operation.

In the operation the speaker believes that dissection from the lateral toward the medial portion of the gland is the method of choice. It permits of better visualization of the parathyroids and the recurrent laryngeal nerve. Local anesthesia is preferable to general anesthesia.

Dr. Charles H. Frazier said that two of the patients had evidence of hyperthyroidism and had been treated by roentgen ray before the operation. This complicated the situation to a considerable degree and made the operation more difficult. The recurrent laryngeal nerve leaves the groove between the trachea and the esophagus, passes outward and then under the inferior border of the inferior constrictor of the pharynx. There it divides into its two major branches. It is in this area that one finds the lobe most difficult to remove and if one is not careful the recurrent laryngeal nerve may readily be damaged. The majority of surgeons do not realize that it is in this zone that the recurrent laryngeal nerve is most frequently injured. As for the end-results of total ablation, sufficient time has not elapsed. We must recite our experiences as they occur from time to time and be extremely careful in the selection of cases. In any case where the signs of decompensation do not disappear entirely after a reasonable period of rest total ablation is contra-indicated.

Dr. Hubley R. Owen remarked that Doctor Lahey stated the operation could be performed in the presence of auricular fibrillation. He wished to ask Doctor Wolferth's opinion regarding the advisability of operating under those circumstances.

Doctor Wolferth replied that fibrillation is not regarded as a contra-indication by most surgeons. The emphasis seems to be on the ability of the heart to come back, rather than the fibrillation.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

CLINICAL MEETING AT THE ROOSEVELT HOSPITAL, NEW YORK, NOVEMBER 28, 1934

REPORTS OF CLINICAL CASES AND STATISTICAL RÉSUMÉ

SOLITARY CYSTS OF THE KIDNEY

DR. JAMES I. RUSSELL

UNFORTUNATELY, there has been much difference of opinion as to the proper limits for the application of the term "solitary cyst" of the kidney. Some have included the hemorrhagic cysts in the group along with the serous cysts. About 275 cases have found their way into the literature, the serous cysts being about six to one more frequently encountered than the hemorrhagic.

A few of the so-called hemorrhagic cysts probably represent serous cysts into which there has been slight bleeding, and it is well known that other hemorrhagic cysts are associated with malignant disease of the kidney. However, Judd feels that most of the solitary hemorrhagic cysts represent the late result of rupture of small aneurysms, and are somewhat analogous to hemorrhagic cysts of the spleen. Nephrectomy is usually indicated, more conservative surgery being rarely advisable.

It would seem much simpler and more satisfactory to consider the serous solitary cysts as a separate entity. The term was designed to distinguish them from polycystic disease, and from small cysts associated with nephritis. It has been applied to an uncommon type of thin walled cyst, usually occurring at one of the poles of the kidney, and sometimes reaching a very large size. They very rarely reach the pelvis of the kidney, but may be separated from it by only a thin membrane. They may be unilocular or multilocular.

There are no characteristic symptoms, and attention is drawn to their presence usually only by the feeling of a mass—by the patient or the doctor. The lower pole cysts usually show up nicely in plain roentgen ray films. Those at the upper pole may be very difficult to demonstrate. Pyelograms may be normal, or may show defects suggestive of neoplasm. There may be enough effect on the function of the involved kidney to enable one to demonstrate a difference on the two sides.

The origin of these cysts has been much in doubt. The age incidence averages 45, and it is doubtful if many of them are congenital in origin. The interesting work of Hepler would seem to demonstrate that two factors

TABLE I

Name	Age, Sex	Date	Att'g.	Complaint	P.X. and Lab.	Path. and Course
1. L. Clayton Path. 2112 B 331	34 F.	1910 3/14 4/3	Peck	Cramplike pain in left side 4 yrs. Frequency, burning, tenesmus. Red clots 6 mos.	Mass R.U.Q. Smooth, tender, movable. Occasional WBC. Granular casts.	Cyst lower pole. Excision. Nephropexy. Size of orange.
2. S. West Path. 4687 B 1072	64 F.	1910 11/23 Died 12/2	Lambert	Pain, sharp radiating to vulva from right iliac. Followed lifting trunk.	Tenderness right abdomen most marked along Pouparts. Lower pole palpable. Few RBC.	Cyst lower pole. 2″ diam. Clear. Sutured. Nephropexy. B. Aerog. Cap. Inf.
3. H. Joseph Path. SA2088 A8124	6½ M.	1917 3/18 Died 3/27	Dowd	Pain left abdomen; painful urination 3 days. Bulging left abdomen from birth.	Asymmetrical enlargement of left side abdomen from costal margin to crest to midline; painful, smaller left.	Horseshoe. 3 qts. thin pus. Cyst practically replaces left kidney.
4. C. De Pew Path. SA A15721	33 F.	1919 7/3 to 8/30	Hotchkiss	Pain left abdomen and up and down spine, aggravated by postural changes. 3 days.	Max. tenderness below twelfth rib, anterior, and in right lumbar. WBC. 17,000. Polys. 82%. Few WBC. Epith.	Hemorrhagic cyst, congenital, upper pole. 9″ diam. Nephrectomy.
5. W. Westerfield A20161 P. P.	? M.	1924 6/22 Died 11/10	Stillman	Fracture neck femur and tibia. Occasional RBC and WBC. Died 129th day.	Autopsy: Cyst upper pole right kidney 215 cm. One calix entered.	

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6. R. Morotta B21747	45 F.	1925 10/26 to 12/16	Peck	Sudden severe intermittent pain right lumbar to groin, 3 wks. Frequency, burning, hematuria. Fell on ladder 22 mos. prev.	Large, irreg. tumor filling right costovertebral angle and anterior to umbilicus. Inf. crest il. Occasional RBC.	Lower pole cyst. Excised and sutured.
7. T. Gaffney B 28227 Roentgen ray 1395	28 M.	1930 2/20 to 3/7	Stillman	Constant dull pain in small of back aggravated by activity. Blood? 2½ yrs.	Pyelogram solitary cyst upper pole right kidney.	Palliative. Ruptured.
8. J. Morse B340820	68 M.	1934 2/26 to 4/8	Cave	Vague generalized abdominal pains. Marked diarrhea and vomiting 5 days. Decrease in urine. Shot in back 30 yrs. ago.	Firm mass L.U.Q. palpated 4 cm. below costal margin. B.U.N.: 68. Rare WBC and RBC. WBC 10,200.	Exc. sol. cyst, lower pole left kidney 25 cm. diameter.
9. F. Sikes Path SD97 A342021 P. P.	60 M.	1934 5/13 to 6/28	Kilbane	Profuse hematuria 21 days following exertion. Pain radiating to groin.	Few RBC. Cystoscopy negative Roentgen ray? Right kidney palpable.	Large cyst, lower pole cyst adenoma, tubule. Nephrectomy.
10. C. Metros A342357	48 M.	1934 6/2 to 7/3	Cave (Kilbane)	Vague ache right flank 2 mos. Painless hematuria increasing pain past week.	Tenderness below 12th rib, right. Roentgen ray 3504. Tumor.	Aspiration and excision cyst, (orange) lower pole right kidney.
11. V. Sokolowski Path. SD 877 A344390	40 F.	1934 10/25 to 11/12	Russell	Pain R.L.Q. and lumbar dragging; following kick in abdomen 3 yrs. R.C.V. angle to groin. Burning, nocturnal frequency.	Movable mass R.U.Q. 10 x 6 cm. Roentgen ray 6732. Urine loaded RBC.	Cyst lower pole right kidney. Excised.

are necessary: (1) the obstruction of a group of tubules, and (2) interference with the blood supply to the same area. He was able to product cysts experimentally that look very much like those seen clinically in this group.

The tendency to occur at the poles, to be just beneath the capsule, and often to involve the kidney but little makes these cysts amenable to conservative surgery. Usually little or no renal tissue need be sacrificed. If the cyst occurs near the midportion of the kidney, and if there is much distortion, nephrectomy is indicated, provided, of course, that careful investigation has been made of the other kidney. This is extremely important, for these cysts may be encountered most unexpectedly in the course of abdominal exploration.

We have had 11 cases of solitary cysts of the kidney in the last 25 years, one of which is questionable and might be deleted (TABLE I). It seems extraordinary that four of the 11 cases have been seen in the last nine months. These were located, six in the lower pole, four in the upper pole—one hemorrhagic, three serous, and one horseshoe, not described.

CASE PRESENTATIONS

CASE I.—J. M., male, 68 years old. Admitted to Roosevelt Hospital nine months ago, on account of diarrhea and vomiting. Examination showed a firm, oval mass in the left side of the abdomen, which seemed to be somewhat movable and measured 25 centimeters in length. In spite of careful preoperative study, the nature of this mass was in considerable doubt.

He was explored by Dr. Hugh Cave on March 9, 1934, under cyclopropane, and a very large cystic mass originating from the lower pole of the left kidney was removed. His immediate postoperative course was stormy. He has since remained well.

CASE II.—V. S., female, aged 40. She had had a pelvic operation in this hospital in 1932; at that time, the right kidney was palpated through the lower abdominal incision and was found to be movable and enlarged. The operator thought that there were some cysts on the surface of the kidney. Since that time she experienced some discomfort in the right flank, and was readmitted one month ago, at which time a mass could be palpated in the right side of the abdomen. It was strikingly movable and somewhat tender, but did not feel like a kidney, being somewhat irregularly shaped.

October 31, 1934, she was explored by Dr. James I. Russell. A multilocular cyst was found at the lower pole, about 4 centimeters in diameter. It shelled out easily, without any disturbance of the adjoining renal tissue, and made an uneventful recovery.

GANGLIONEUROMA OF MEDIASTINUM

Dr. James I. Russell also presented E. P., female, 12 years old, with a history of recurring attacks of violent coughing for a year and a half. She was admitted to the Children's Medical Service four years ago for study. Roentgen rays showed a large, dense, spherical shadow at the upper pole of the right pleural cavity. The nature of this mass was much in doubt and various studies did little to help toward a more accurate diagnosis.

Exploration was done under intratracheal anesthesia November 14. A posterior approach was used, with resection of portions of the third, fourth

and fifth ribs. The tumor was exposed and gradually removed by careful blunt dissection. There was a small pedicle through which the blood supply came, which was opposite the third dorsal vertebra. At no time during the operation did the lung collapse, even if the pressure anesthesia was withheld. One very small opening was made in the pleura and promptly repaired. The patient made a smooth postoperative recovery. Pathologic report was a ganglioneuroma, arising from primitive sympathetic nerve structures. The patient has been followed at intervals since, and has remained well.

RHINOPHYMA

DR. GRANT P. PENNOYER

I DO not think that many general surgeons appreciate how easy it is to give a patient with rhinophyma a good cosmetic result. The disease is extremely disfiguring and it is surprising how the general morale of a patient is improved by restoring the natural appearance of his nose. It is true that the disease usually occurs in people of the lower strata of society where vanity is not greatly emphasized, but even in this group, these patients often take a new lease on life with the removal of their disfigurement.

The patient presented had a nose so large that he could see his feet only with the greatest of difficulty and he had become a recluse, because as soon as he appeared on the streets he was ridiculed.

My interest in the disease was stimulated many years ago by seeing Dr. James White, Professor of Dermatology, operating on a huge rhinophyma in a back room, while loudly denouncing surgeons for not operating upon these cases in the manner in which he asked them to operate. Doctor White was not a surgeon. He simply whittled off the excess tissue exactly as one would whittle a stick. There was considerable hemorrhage which was entirely controlled by pressure with gauze sponges.

Doctor White showed me a large number of pictures of excellent end-results in these cases, some going back for more than 30 years, and said that his predecessors had taught him to do the operation before that. Despite this convincing evidence, he was unable to persuade the general surgeons to take over these cases.

The operation consists simply of paring off the lobulations of diseased tissue so that the nose at the completion of the operation is of normal size, though apparently completely denuded of skin. Care must be taken not to enter the nostril or injure the nasal cartilages. An instrument can be placed in the nostril to appreciate the thickness of the tissue left, if one suspects that he is removing too much. Some arteries may have to be tied, but most of the hemorrhage can be controlled by pressure. I have been dressing them with rubber tissue, and it is amazing how rapidly the denuded area is epithelized. The reason for this is obvious if one studies the microscopic sections. The excess tissue lies in lobules at the base of which remain islands of epithelial tissue which are left on the nose and from which the new epithelium

rapidly grows. Healing is usually complete in less than three weeks. Areas of epithelial tissue are also scattered in the lobules themselves, so that it is almost impossible not to leave some epithelium on the nose, although it is not grossly apparent.

These patients all have thick acneform skin which, of course, is not cured by the operation, but the nose itself remains fairly normal and in our experience the condition does not tend to recur. Roentgen ray treatment, as far as the nose is concerned, has not been necessary.

Patients with this condition are almost all poor and totally unaware of the ease with which it may be corrected. They usually come to the hospital with some other complaint. The operation, therefore, has to be sold to them. I have never yet had a patient come to me first for the nose.

It is hoped that in presenting this patient the interest of the general surgeon may be stimulated regarding this condition so that he will voluntarily offer to relieve the unfortunate sufferers of this disfigurement.

STRICTURE OF RECTUM FROM LYMPHOGRANULOMA INGUINALE

DR. ALFRED STILLMAN

I DO not recall either the question of stricture of the rectum or lymphogranuloma inguinale having been discussed before this society. Articles appearing in the Journal of the A.M.A. in 1932 and 1933 by de Wolf and Van Cleve, H. N. Cole and Collier Martin on lymphogranuloma inguinale. Its relation to stricture of the rectum has aroused my interest.

Briefly described, lymphogranuloma inguinale affects more usually the Negro during the ages of sex activity. In the male it produces a lesion on the penis—herpetic, ulcerative, nodular or urethritic—which is evanescent. After ten days to three weeks the draining lymph nodes enlarge, mat together and, in time, break down at several points, forming multiple sinuses. These tend to heal after months by scar tissue. In the female, however, the consequences of infection may be more serious, for, as Barthells and Biberstein have shown, the drainage from the posterior vaginal wall is along the rectal channels. This results in rectal inflammation with formation of strictures—bands or tubular constrictions—fistulae, ulcers and elephantiasis of the external parts, with involvement of the vagina and pelvic floor. The disease is thought to be caused by a filterable virus and Wilhelm Frei developed a skin test which he and others consider specific.

Treatment so far has not been very successful. The glands may be excised but too extensive removal must be avoided as elephantiasis results. Antimony and potassium tartrate are given intravenously. Martin says the stricture cases need colostomy sooner or later to save or prolong life.

To date I have seen six strictures of the rectum, all in women, five of them colored. In three the stricture was bandlike and in the others tubular.

Case Reports

Case I.—M. J., colored, 34, married at 17. When she believed herself five months pregnant she was operated upon for appendicitis. While in the hospital a thermometer broke in her rectum and later a rectovaginal fistula resulted. In 1923 she had a miscarriage. Constipation was an increasing complaint. In 1930 she had to have a cecostomy for acute obstruction.

At this time she weighed 95 pounds; previously she weighed over 200. She came to Roosevelt Hospital last July. She then weighed about 140 pounds. Her lungs were clear. The Wassermann was negative, but the Frei test was positive. She had a rectovaginal fistula, a tight tubular rectal stricture, and a cecostomy. It was thought advisable to make a permanent colostomy. After a low midline incision, the sigmoid and colon were raised with considerable difficulty owing to the shortness and involvement of the mesocolon, by incising along the viscero-parietal edge. When the loop was sufficiently free it was brought out through an intermuscular incision and the colostomy established later. It functions well. The cecostomy has opened once or twice and may need a secondary operation for closure.

Is this a case of lymphogranuloma inguinale with rectal fibrosis and stricture? It simulates the condition described in the literature. Her Wassermann is negative and the Frei test positive though not markedly. A complement fixation test is one plus. She has no pulmonary evidence of tuberculosis.

Case II.—A Negress, 43, married, has had five pregnancies with three miscarriages. She had malaria in 1902, a hemorrhoid operation in 1922, after which she began to complain of constipation. In 1927 she had pneumonia and in 1929 some stretching operation of the rectum.

She was admitted to Roosevelt Hospital February 13, 1934, with a history of progressive weakness in the past year, the loss of 30 pounds in the last six months, and diarrhea between attacks of marked constipation. With the diarrhea she passed blood. Her Wassermann was negative as was the Frei test. Physical examination showed the cervix to be torn and pointing forward while the fundus was back and attached to a firm, tender, fixed mass about eight centimeters long. There was a tight tubular stricture immediately above the sphincter. A biopsy from the rectum was reported ulceration with suppurative inflammation. Her weight was 95 pounds.

It was evident the rectum could no longer function. A colostomy was advised. This was done a week after admission through an intermuscular incision after a low midline incision for exploration. The rectum and sigmoid were found thickened and the mesocolon shortened by inflammation. The tubes were closed, the left attached to gut, the right containing a small hydrosalpinx.

Forty-four days postoperative the patient was reopened for intestinal obstruction. The small gut was everywhere adherent by thin veils but one strong band caused complete obstruction. There was a large amount of clear fluid in the peritoneal cavity but one loop had gotten between the colostomy and the parietal wall as had been considered likely. The band was divided and one or two serosal tears repaired. The patient died eleven days later of peritonitis.

Autopsy showed a perforation of the small gut 18 inches from its end. The sigmoid, rectum, uterus, vagina, *etc.*, were removed in one piece. Splitting up the rectum showed a thick fibrosed wall. The uterus and vagina were not involved. Microscopic examination showed the entire wall of the rectum fibrosed and infiltrated diffusely with mononuclear leukocytes and

plasma cells. No parasites were seen in section. The serosal fat was infiltrated with leukocytes and showed an increase in the capillaries. Some zone of necrosis and giant cell reaction was seen.

Diagnosis.—Chronic colitis and diverticulitis with fibrosis, stricture and pericolitis. Acute general peritonitis. Gangrene of the terminal ileum with pelvic abscess. Colostomy. Cystic ovaries.

What was the cause of the stricture in this patient? The Wassermann and Frei tests were negative and there were no signs of tuberculosis. The inflammation extended quite high in the rectum and sigmoid and was still active at the time of operation as shown by the extensive adhesive peritonitis at the second operation, with still later a perforation and death.

OSTEOMYELITIS OF SKULL WITH INTRACRANIAL ABSCESS

Dr. Howard A. Patterson presented a young man who entered the Roosevelt Hospital 17 months ago, with a right orbital cellulitis, presumably an extension from the ethmoid. He also had involvement of the right frontal sinus.

The frontal sinus and orbital cavity were opened widely. He ran a very stormy course, the blood cultures being positive for *Staphylococcus aureus.* One month after admission he presented two urgent surgical problems: one, a rapidly advancing osteomyelitis of the skull, the other, an intracranial complication. When first seen he had a left hemiplegia, was able only with great difficulty to coöperate at all in a neurologic examination, and was still running a very high septic temperature, with positive blood culture. The optic disks showed a high degree of choking. It seemed likely that there were multiple brain abscesses.

The osteomyelitic process in the right frontal bone was spreading rapidly, and had extended over to the left of the midline. His precarious condition made a very radical bone resection inadvisable. The patient was comatose, and it became increasingly difficult to administer fluids. A conservative bone removal was done in the center of the involved area, a circle four centimeters in diameter being removed. This allowed inspection of the frontal dura, which was found clean and free of granulations. There was no epidural abscess, and no evidence of an intradural abscess in the frontal region. A posterior trephine was made, and the dura found to be red and angry looking. The subarachnoid space was obliterated. At a short distance beneath the dura, a tough membrane was encountered, much like the dura itself. The ventricular needle was forced through this membrane, and a quantity of *Staphylococcus aureus* pus (250 cc.) was obtained. The scalp was closed without drainage. The roentgen rays taken at that time show the abscess cavity partly filled with air, and roughly spherical in shape (Fig. 1). At that time it was thought the abscess was really intracerebral. Within three hours after aspiration, the boy was sitting up eating, and his hemiplegia had largely cleared.

Twelve days later the boy was again stuporous, and the left-sided weakness returned. The cavity was again emptied by aspiration. It contained more than 300 cc. of pus, showing a pure culture of *Staphylococcus aureus*. The cavity was almost completely filled with air (Fig. 2), there being only

FIG. 1.—Lateral skull plate showing abscess cavity partly filled with air at time of the first aspiration. At this stage, the osteomyelitic destruction in the frontal area was at its height.

FIG. 2.—This shows the abscess cavity completely filled with air. The process apparently started anteriorly, and extended back to the tentorium.

a small collection of fluid at the bottom. It then looked as if the huge abscess were really subdural, and not intracerebral, and that it had begun to form beneath the frontoparietal suture, and extended backward to the tentorium. Two more aspirations were done. At the time of the last

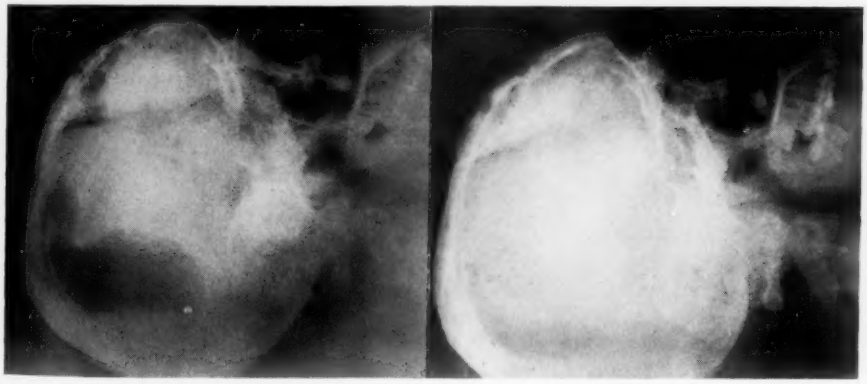

FIG. 3.—Showing fluid level in abscess, after partial emptying by aspiration. Lateral plate, taken with boy looking upward.

FIG. 4.—Showing small abscess cavity at time of fourth and final aspiration. Note also great improvement in the frontal osteomyelitis.

one the cavity (Fig 3) had a capacity of only 45 cc., and the pus was sterile. It has now been more than a year since the last aspiration, and we have had no more worries from that phase of the case. Neurologic examination is entirely negative and he is symptom free.

There has been an amazing regression of the osteomyelitis throughout the period during which we were occupied with the subdural abscess (Fig. 4).

The boy's condition contraindicated any radical measures. Conservative drainage incisions have been made here and there, and one small sequestrum has been extruded spontaneously. There has been a slow but steady improvement. The boy runs a perfectly normal temperature, although the frontal sinus area is still draining.

It may be that we will yet have to do the procedure recommended in such cases by Dr. Furstenberg of Ann Arbor. His plan would be a two stage removal of the entire frontal bone, right and left, wide of all involved bone, packing loosely between the scalp and dura. He would be confident that there would be adequate bone regeneration, having had many such cases in his personal experience. If the improvement in this case ceases, we may have to abandon our conservatism. Most of the discharge, at present, seems to come from a sequestrum at the superior orbital margin, which I think is loosening up. It is planned soon to remove it.

ACUTE INTESTINAL OBSTRUCTION

Dr. Frederick H. Amendola (by invitation) presented a statistical résumé of the last 200 instances of this condition occurring in the Surgical Services at the Roosevelt Hospital, New York, for which see page 1250.

BRIEF COMMUNICATIONS

MESENTERIC CYST

THE patient, a boy nine years of age, was first seen June 14, 1932. His health had been unusually good until early in the morning of that day when he began to complain of nausea and loss of appetite. In the afternoon he developed rather severe colicky pains in his lower abdomen which seemed to localize more in the right portion than the left. They continued intermittently and the next day they were sharper and more frequent as well as accompanied by spells of vomiting. The evening of the second day the pain seemed to be located mostly in the right upper portion of the abdomen and for the first

FIG. 1.—Appearance of cyst on opening abdomen. Mass between stomach and transverse colon.

time a mass, lying to the right and just above the level of the umbilicus, was noticed by both the boy and his mother. The next day the boy appeared fairly well; his temperature and pulse were normal and on physical examination nothing of note was found except a rounded movable mass in the right upper portion of the abdomen just under the costal margin. This measured twelve to fourteen centimetres in diameter, it was not tender and it was not attached to either the posterior or anterior abdominal wall, although it lay quite close to the latter.

Exploration of the abdomen through a right rectus incision was done June 17, 1932. A large rounded cyst (Figs. 1, 2 and 3) measuring 12 centimetres in diameter was present

FIG. 2.—Greater omentum and transverse colon pulled upward showing posterior surface of cyst.

lying in the mesocolon between the greater curvature of the stomach and the transverse colon. In the process of removal of the cyst its wall was ruptured, allowing a dark red fluid to escape, but the margins of the cystic area were removed completely without interference to any of the large vessels of the mesentery or with the stomach or colon. The defect in the mesentery was repaired without difficulty. Convalescence was uneventful and the boy left the hospital the twelfth day postoperatively. He has been well ever since (May 15, 1932).

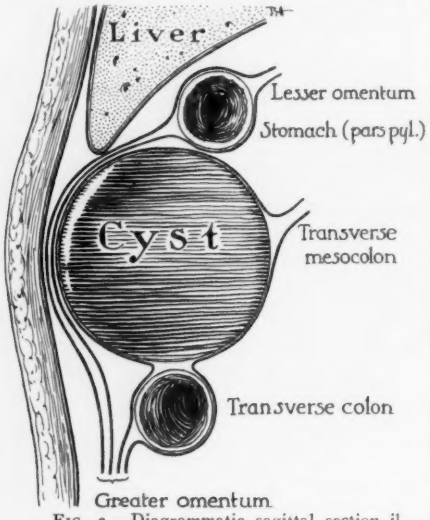

FIG. 3.—Diagrammatic sagittal section illustrating position of cyst between the leaves of the mesocolon.

Sections for microscopical study taken through the mass of tissue removed showed a massive infiltration with blood. No definite lining to the cyst could be made out.

In the recent review of twenty-two cases of primary mesenteric tumors, Rankin and Major[1] found only two which were of cystic sanguineous character, such as that reported in this communication. Likewise from a review

of the literature it seems that this type of lesion is quite rare. Moynihan[2] has postulated that the usual etiological factor in cysts of this kind is trauma and he further states that hæmorrhages of this character and in this location may result in several alternatives: the hæmorrhage may develop into a cyst, the hæmorrhage may occur in a preëxisting cyst, or into a solid tumor of the mesentery, the greater part of the solid constituents of the effused blood may disappear and a simple serous cyst result, or, finally the fluid component of the blood may be absorbed and a more or less solid tumor persist. The solid tumors of this location are composed of the lipomata, fibromata and malignant neoplasms, especially sarcomata. The diagnosis of these tumors is not easy because of the multiplicity of symptoms which they may produce. However, in the presence of any mobile abdominal mass extrinsic to the gastro-intestinal tract, mesenteric neoplasm should be borne in mind. According to Rankin and Major, the prognosis of benign tumors is favorable but in malignancies it is poor.

In the case presented, no doubt a trauma of some sort was the cause of hæmorrhage into the mesocolon resulting in the formation of a hæmatoma and this was removed before any complications could take place. The differential diagnosis was difficult until the hæmatoma manifested itself by the presence of a mass. When this took place, surgical intervention was imperative. The extirpation of the cyst was attended with considerable technical difficulty due to the proximity of the mass to the large vessels of the colon and stomach so that freeing and removal of the tumor was rather hazardous.

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ACQUIRED RENOCOLIC FISTULA

TO THE cases of acquired renocolic fistula already recorded in the medical literature, because of its rarity, we desire to add one observed in the Graduate Hospital, University of Pennsylvania, on the service of the late Professor B. A. Thomas.

CASE REPORT.—H. K., Chinese, aged forty-three, entered hospital April 26, 1929, complaining of a pain in the right side of the abdomen, right leg, and testicle, and of having a growing mass in the right side of the abdomen. *Previous History.*—At the age of twenty-two, while an apprentice carpenter, he had two falls, each twenty feet in height. In one of these, he struck his right side and remained unconscious for three hours. *Present History.*—About ten months ago, the patient noticed severe pains in the right lower quadrant lasting more than ten hours. Pain started in his side and radiated toward the umbilicus and to the angle of the right scapula. Had no fever, no urinary symptoms. About the same time, the patient noticed a small mass in the right side of the abdomen. The mass increased in size and moved toward the umbilicus. As the mass increased the patient experienced pain in

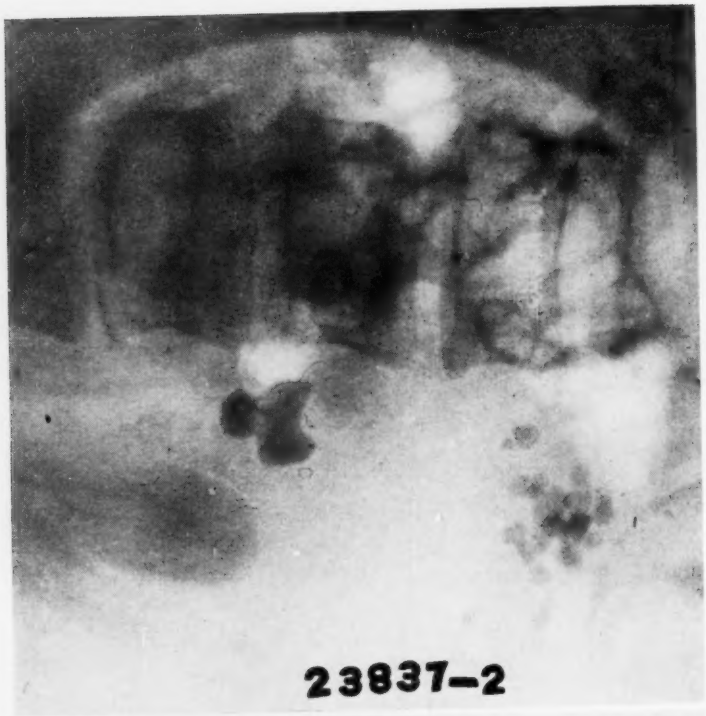

FIG. 2.—Intravenous cholecystogram shows normal gall bladder. Staghorn stone and many small calculi in the right kidney.

FIG. 1.—X ray after barium enema. In the first portion of the transverse colon there is a filling defect (site of the fistula).

the right thigh and in the right testicle. Because of the pain, the extension of the right leg became impossible. For the same reason he was confined to bed.

Physical Examination.—This showed the patient to be emaciated. Pulse, regular. Abdomen, superficial veins were prominent and distended (caput medusæ). Above umbilicus, right side of the abdomen was rigid; the upper recti were tense, the lower semi-relaxed. There was a large mass on the right side of the abdomen extending from the posterior to the brim of the pelvis. It was slightly lobulated. Extreme tenderness on slight palpation of that area. Genitalia and rectum, negative. Extremities, right thigh in a semiflexed position, attempting to extend it fully caused pain in the right lumbar area. Veins, prominent. No œdema. Reflexes, hyperactive. Blood culture taken few days before death showed hæmolytic streptococcus.

Gastro-intestinal Tract.—Œsophagus, negative. Stomach, elongated; lower pole region opposite the fifth lumbar vertebra. The pylorus appeared to be slightly displaced to the left, giving the stomach an exaggerated "J" shape, and could not be forced over to the right side by palpation. Walls, flexible. Duodenal cap, slightly enlarged and could not be shifted about by palpation. No filling defects noted. Duodenal cap received and emptied its contents promptly. Dilatation of second and third loops of the duodenum with anti-peristalsis and writhing movements were seen on the fluoroscopic, although barium passed through to the jejunum at irregular intervals. In six hours the stomach emptied, the bulk of the meal distributed through the cæcum and descending colon. After twenty-four hours, there still remained a small portion of barium in the cæcum and transverse colon. The bulk of the meal remained in the descending colon. After bowel movement, the rectum was empty. Barium given by enema passed through without difficulty to cæcum which was low in position and extended down to the true pelvis. Hepatic flexure at level of the fourth lumbar vertebra. The defect in the first portion of the transverse colon was apparently from pressure. (Fig. 1.) Splenic flexure—level of the first lumbar vertebra.

Chest.—There was an old fibroid tuberculosis in both upper lobes, especially marked in the left upper lobe. The liver was apparently enlarged. Measurements were as follows: vertical, 21.8; oblique, 27.8 centimetres.

A group of three large calculi showed at the level of the second lumbar and a group of approximately twenty to thirty smaller calculi showed at the level of the fifth lumbar vertebra (Fig. 2).

Cystoscopy.—Bladder walls, congested. Left ureter, easily catheterized. Attempts were made to pass catheter up the right ureter but an impassable obstruction was encountered about one centimetre from the orifice. No dye was excreted by the left kidney in more than twenty minutes.

Retrograde Pyelography.—The left kidney was larger than normal, but regular and normal in outline and position. The right kidney outline was not visible. No opaque media was in the ureter. There appeared to be a stone in the pelvis of the right kidney and many smaller calculi below it, apparently located within the kidney.

Patient died twenty-four days after admission, without operation.

The Chinese custom of insisting on having the remains buried in China, allowed only a superficial examination of the organs, without removing any part of them. Autopsy showed the left lung had firm adhesions at apex. Right lung, apex adherent, firm adhesion posteriorly. Firm tubercle at the apex. Pericardium, smooth, fluid blood-tinged. General visceroptosis. Liver, normal. Gall-bladder, normal. Stomach, dilated. Spleen, pale, evidence of petechial hæmorrhage on the surface. Appendix, normal. Left kidney, larger than normal; capsule, strips freely. Ureter, normal. Right kidney, enormously distended with fluid and firmly adherent to colon. Kidney, friable, when opened many stones were delivered. There was a fistula between the first part of the transverse colon and kidney.

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MALUNITED SUBTROCHANTERIC FRACTURE OF FEMUR

CORRECTION BY OPEN METHOD

CASE.—A white male, aged sixty, was struck by an automobile and removed to a hospital. The X-ray examination showed a subtrochanteric fracture with a linear fracture through the lesser trochanter, the fragments in fair position. (Fig. 1.) The surgeon who attended this patient, in attempting to reduce the fracture, used the *abduction* treatment and applied a plaster-of-Paris spica. X-rays taken after the application of the spica showed the shaft of the femur medial to the neck and in contact with the pubic bone. (Fig. 2.) No attempt was made to correct this malposition. At the end of seven weeks, the surgeon removed the plaster and made an attempt to apply a brace, but finding the shortening very

FIG. 1.—Position of fragments before manipulation by the first surgeon.

marked and the deformity most pronounced, decided that a brace could not be applied and the patient continued to remain in bed.

At this point the patient came under the observation of the reporter. An examination then made, ten weeks after the injury, showed the patient with the right lower limb in a position of outward rotation and abduction. The right thigh showed a marked angulation outward, below the greater trochanter. The shaft of the femur could be palpated below the trochanter as markedly angulated. The fragments were firmly united. Measurements in line of deformity showed a shortening on the affected side of about four inches. X-rays

Fig. 2.—Position of fragments after manipulation by first surgeon.

Fig. 3.—First correction after open operation showing improved position of shaft of femur.

Fig. 4.—Final correction of malunited fracture showing condition after three months from time of operation.

made at the time showed the shaft of the femur medial to the neck of the femur and united to it, side by side rather than end to end. (Fig. 2.) A linear fracture of the lesser trochanter could still be made out, but with marked callus formation.

Because of this bony union, correction of the deformity was undertaken by an open reduction. An incision was made linearly along the latero-anterior border of the right thigh. When the shaft was exposed, the periosteum elevated, the fracture line was identified. The exposure was very difficult because of the presence of the femoral vessels, and the tenseness of the muscles. The shaft was pried apart from the neck which had been fused by callus, and by gentle traction and outward rotation, the shaft was gradually separated from its attachments. The callus was curetted off with a large spoon curet, and the fibrous tissue was dissected away. There was some attachment of the upper shaft to the pubic bone, and with a periosteal elevator this was gradually detached. A retractor was then placed in the medial side of the wound, and with a large skid leverage was exerted against the side of the shaft at the same time making downward traction. The shaft was gradually levered laterally into place beside the lesser trochanter. A Steinman pin was then placed through the femoral condyles. The wound was closed in layers; traction was applied by means of the Steinman pin. The reduction at the time of the closure (Fig. 3) was not all that could be desired, but more satisfactory approximation of the fragments was impossible because of the marked shortening of the muscles. Traction on the shaft with the aid of the Steinman pin was applied and continued until it was seen that no real improvement resulted.

Two weeks following the open reduction, the patient was placed on a Hawley table. A general anæsthetic was given and with the aid of the pin in the condyles, marked traction was made upon the shaft until it was felt that the shaft was beneath the greater trochanter and alignment satisfactory. A double plaster-of-Paris spica was finally applied.

The patient made an uneventful operative recovery and ten weeks later the plaster-of-Paris and the Steinman pin were removed, and the patient was fitted with a Thomas caliper leg brace. The range of motion about the hip at that time was very satisfactory and the shortening reduced to 1½ inches on the right side. (Fig. 4.)

Four months after the open reduction, the patient returned to his original work and has been employed steadily since. He walks without a limp, having since been fitted with a right shoe having a one-inch lift under the heel.

COMMENT.—This case of malunited fracture of the femur is described in which the malunion is believed to have resulted from the use by the surgeon of a method applicable to fractures of the neck of the femur but not to subtrochanteric fractures. The malunion was later corrected by a two-stage open reduction, which gave very satisfactory results and permitted the sixty-year-old patient to return to work.

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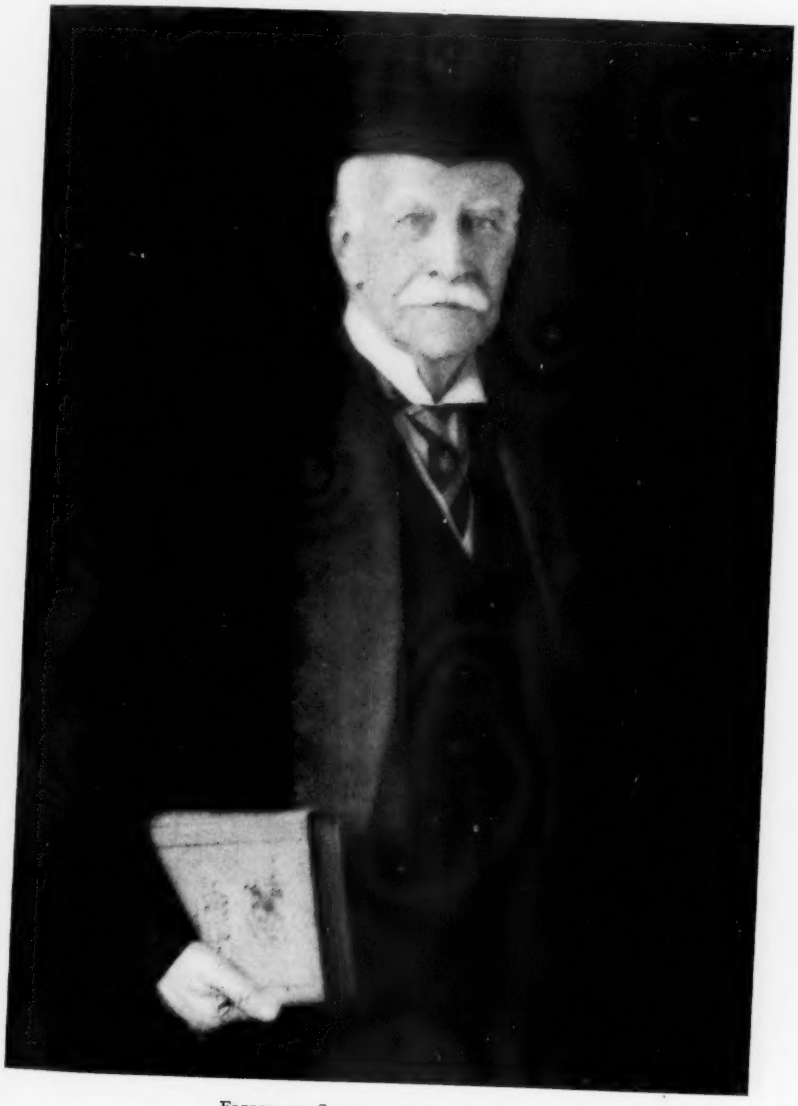
MEMOIR

FREDERICK SHEPARD DENNIS

1850–1934

FREDERICK SHEPARD DENNIS, of New England stock, was one of the oldest residents of Norfolk, Connecticut; born April 17, 1850 and died March 8, 1934. He received the degree of B.A. from Yale in 1872, and two years later that of M.D. from the Bellevue Medical School. After post-



FREDERICK SHEPARD DENNIS, M.D.

graduate courses in various European schools he engaged in the practise of surgery in New York and shortly became a member of the staffs of Bellevue and St. Vincent's hospitals, being chiefly responsible for the introduction of Lister's antiseptic methods in their surgical wards. With his intimate

friend and associate, the late Dr. W. H. Welch of Baltimore, he was instrumental in the organization and conduct of the Carnegie Laboratory. For many years he was professor of surgery in the Bellevue Medical School and was an able and popular teacher. At the time of his death he was professor emeritus of clinical surgery in the New York Cornell Medical School and was consulting surgeon to the hospitals in which he had previously engaged in active service, as well as to several other hospitals in Yonkers and Connecticut.

Doctor Dennis was the oldest surviving member of the American Surgical Association. Elected a fellow in 1882, only two years after the Association was founded by Samuel Gross, he served as its vice-president in 1887 and as its president in 1894. He received the honorary degree of F.R.C.S. from the University of Edinburgh.

A distinguished surgeon, Doctor Dennis was invariably popular in school, at Yale, and in medical circles, and enjoyed many intimate friendships. He was frequently spoken of affectionately as "Fred" Dennis by numerous admirers. For many years, at first in the intervals of a busy practise, and afterward during the spring and summer months, he was much interested in the development of a large estate on one of Norfolk's lofty and beautiful hills, paying much attention to its botanical and horticultural features. Before the introduction of the automobile his stable was one of the best, and this hobby in horse flesh continued unabated in his declining years. In many ways he was Norfolk's leading citizen and his advice was frequently sought in questions of village policy. He maintained an active interest in current events and was a staunch advocate for honest government. Only a short time before his death he came to New York from his country home in order that he might register and vote for a reform administration. With no indication of impairment of mental power his death occurred suddenly and unexpectedly and closed a most noteworthy career, in which he had enjoyed the pleasures of life to the utmost, and in which he had contributed largely to the welfare of his fellow men.

ELLSWORTH ELIOT, JR.

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